No 22

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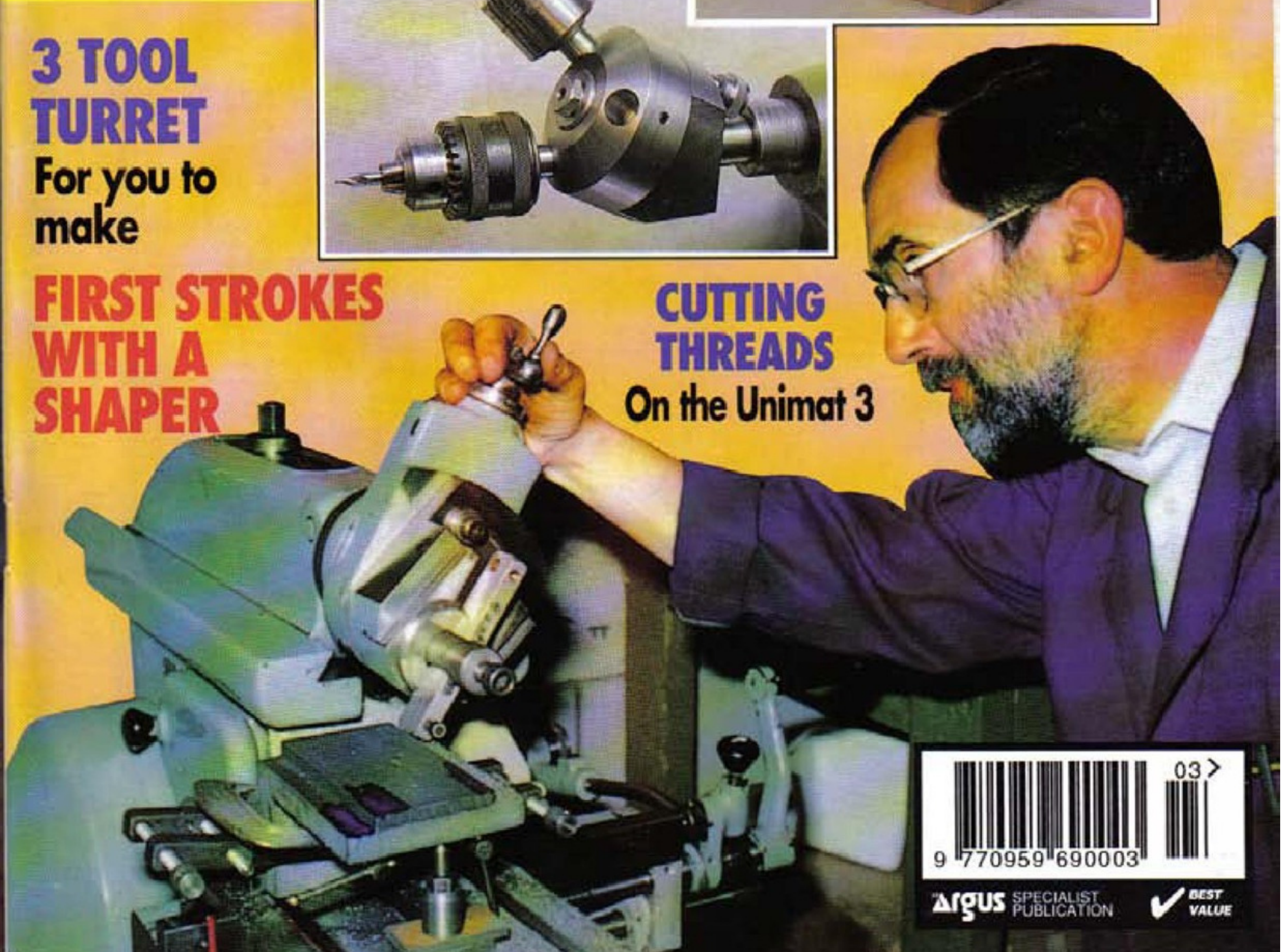

Argus SPECIALIST PUBLICATION

BEST VALUE

Issue No. 22

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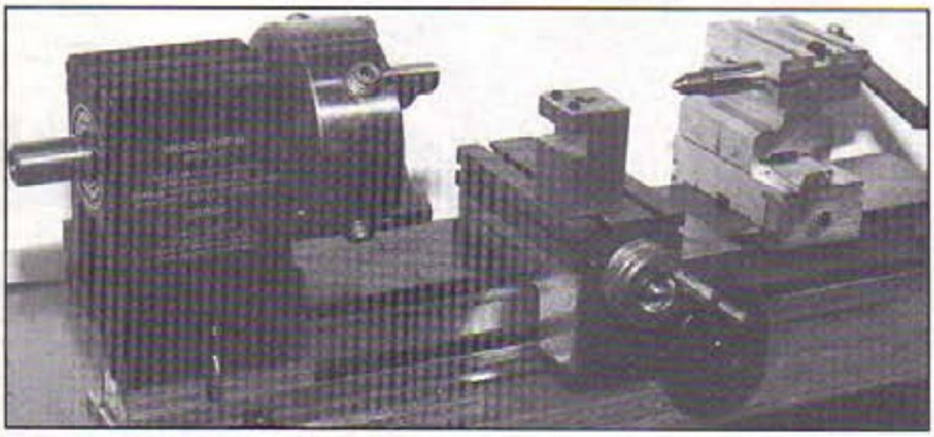

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ADVERTISERS' INDEX

Harold Hall

ON THE EDITOR'S BENCH

The 63rd Model Engineer and Modelling Exhibition

My first words in this issue must be to thank those readers of *M.E.W.* who took up my suggestion, made early last year, to exhibit items of workshop equipment in the loan section of the exhibition. It would be less than honest of me to suggest that this was a resounding success; on the other hand, neither was it a failure. Looking around the exhibition there were quite a number of examples of items that I know had come as a result of this request.

I was myself unable to exhibit, as due to a much more rapid appointment for a short stay in hospital than had been anticipated (this came early in December), the necessary time to organise the exhibits looked improbable. In the final event, a much more rapid recovery than had previously been the case; modern methods are certainly paying off, meant it would have been possible. Many thanks to Stan Bray who exhibited some of the items he had made for the early issues of *Model Engineers' Workshop*; hopefully mine will appear next year.

Elsewhere in this issue is a picture gallery of some items seen.

Scribe a Line

Letters for, or in answer to, *Scribe a Line* have increased in number quite considerably over the last few months. This in part was due to a few items, typically that on the South Bend lathe, generating a large post bag in their own right. It is though obvious that it is a natural progression of *M.E.W.* becoming established as a magazine of interest. Whilst the increase causes some minor problems, streamlining methods now mean that I am back to acknowledging all letters, I may have missed just a few.

The main effect of the increase is that now, more letters than had originally been the case do not end up in print. If your letter is not published, please do not be discouraged from writing again, this is a vital part of the magazine's activities.

Link up

A number of letters of appreciation for this new feature, which supplements *Scribe a Line*, have been received, and signs are that it will be well used.

Referring to the interest in South Bend lathes, generated in a recent *Scribe a Line*, it is now being proposed in *Link Up*, by one reader, that owners of such machines could join in some kind of correspondence circle, to the mutual benefit of all concerned. This seems an admirable suggestion, and the reader in question is prepared to get it off the ground, so if you are a South Bend owner, what's stopping you making contact with him?

An almost identical suggestion regarding Unimat owners is being made by another reader. In this case the reader is very involved in another such group, and someone to become involved is sought. A group, say publishing two or three newsletters a year, may take an hour a week on the part of the secretary-cum-editor. This could be a rewarding task and the benefits to the group could be substantial, so why not offer your services?

However, I must again make a firm request regarding entries being received for *Link Up*. These are not conforming to the conditions laid down in issue 20 page 20 and issue 21 page 12. It would be a great pity if it could not be continued due to the work load it produced at this end. I realise that it is early days, but do please read the conditions and try to conform.

The three items causing most concern are: The entry being included in a letter dealing with other matters or explanation of the entry; not making it clear if the address is to be published; price in excess of the £50 limit.

Steam correspondence circle

I have just received a copy of a newsletter published by the "Steam Correspondence Circle". This is an organisation for those interested in model steam boating. The newsletter is a very creditable publication for a small club, containing some items of workshop practice, including photographs and drawings, a readers' query page, as well as the news and views content. This suggests a well run set up, and should you be involved in this activity, they are looking for active members, then write, enclosing a S.A.E. to D.M. Hodges, Hideaway, Thornton Road, Barrow on Humber, DN19 7EB.

Attending college

Many readers have commented on the diminishing number of colleges providing machine shop facilities for the home engineer. Those who are losing this facility are obviously unhappy with the situation, especially if part way through a project requiring the larger facilities, often the reason for attending.

I learned recently of a group who were very unhappy when the college they attended closed down the workshop evening. At first, after applying some pressure collectively on the college and getting nowhere, the situation appeared without hope.

However, with continued discussions with the college a novel method for overcoming the problem was arrived at. The City and Guilds machine shop course, I am unsure of the official title, was somewhat oversubscribed during the day. This, together with the fact that a few students for this course would prefer to attend in the evening, meant that an evening course would be desirable.

There were insufficient students to merit an evening class until someone came up with the idea of amalgamating this with the defunct workshop evening. All that was required of the workshop students(?) was that they would have to make the test pieces for the City and Guilds course, after which the workshop facilities were there for their use as desired. They would also have to sit the final test. Even so, the information as I understand it is that the workshop students are more than happy with the final outcome.

I am not saying this is the answer to the situation at every college, but a word in the ear of a suitable college official may make it a possibility in some. In defence of the colleges themselves, and at the risk that I will get some feed back on this, I must say that I feel some are expecting facilities on the cheap. Many will pay as much, and frequently much more, to stand for two hours on the terraces every other Saturday to see a football match. I realise that prices vary widely which does seem unreasonable, and perhaps the highest are a little over the top.

Index

Some readers will, I am sure, be looking in this issue for the index relating to last year's issues. Unfortunately, the data base I was using was finding it difficult to come up with the goods as the number of issues increased, and therefore the records involved. Whilst the records for an individual year will be about the same, the database was being used collectively to keep all the records from issue one, hoping that periodically it may be possible to make this available to you in some form. The options would be to obtain it on disc or to request photocopies of the computer print out, then very occasionally, say every ten years, a printed booklet.

The failure of the program to cope has caused me to look for an alternative. Having created programs for quite complex databases, using dBase III plus, in my last job, it is not surprising that it is in that direction that I have been prompted to move. I now have obtained a copy of dBase IV v2 and the initial attempts look very encouraging. I have also obtained a compiler, and hopefully it will be possible eventually to provide on disc an executable program (.EXE), this will enable the viewer to view the indexes in various arrangements. Of course paper copies will be made available for those who want them.

In the meantime, the main effect is that the published index will be delayed for an issue or two.

LINK UP

Reader to reader service – help – queries – small sales – wants – and it is all free!!
Plain = Wants, Tinted = For Sale

Has anyone got or know where I can get a flywheel for a 1½in. scale Burrell with cast oval or rounded spokes?

Does anyone have a surfeit of oblong tobacco tins, large or small? Tel. 0767 31 3164 (Bedfordshire).

Is there anybody who has a copy of the Argus Publication "Using the Small Lathe" by L.C. Mason for sale please? Tel. 0442 863026.

I would be interested to hear from owners of ML4 lathes who have carried out modifications and improvements on the design. Tel. 0892 546059.

I am seeking help in obtaining a spare "lower arm" for a Naerok fretsaw model SS16.

The Naerok company is no longer trading but I believe another company may have taken over its trading facilities.

Could any of your readers supply me with an address from which I could obtain such a replacement? Tel. 0253 778598.

Do any readers owning South Bend lathes consider that it would be of any use to have a country-wide register of owners, with the purpose of mutual help with information, assistance etc? I would be prepared to get it off the ground.

My machine is a 10in. South Bend, serial number 153189, shipped 1944.

Please write or phone/fax to S.T. Lawrence, The Old Mill, Canterbury Road, Lyminge, Folkestone, Kent. CT18 8JW. Phone/fax 0303 862393.

I recently acquired a Pools lathe, initially supplied by Buck and Ryan. Can any reader supply me with a copy of the handbook for the machine, and details of where I may be able to obtain spares? I require a faceplate and a chuck for the machine, but without a faceplate I am unable to machine a back plate for a new chuck. Has any reader a surplus faceplate or chuck they would sell to me? Failing that, could anyone either machine for me, or loan me, a faceplate so that I could get started on a backplate?

I am very new to this activity, and would ask if there is anyone in my area who would be prepared to advise me from time to time?

Write or phone to Penn-y-Less, New Road, Peterstow, Ross-on-Wye, Herefordshire, HR9 6JZ. Tel. 0989 64760.

I have a Little John lathe but require a chuck for this. Has any reader a surplus one which they would be prepared to sell me or alternatively details of where I can get a backplate machined? Would any reader be prepared to do this for me? The nose has a 1.750in. dia. spigot ½in. long and a 6 TPI square thread. Tel. 0254 581209.

I am still trying to get the digital readout on my miller to count in units of 0.0001in. I have successfully had the X1 cct. from M.E.W. working, but would like to use the X4 cct. in conjunction with a slotted disc that has 250 slots, thereby moving the miller table in increments of 0.0001 inch.

Has anybody used this X4 cct. or perhaps can produce a wiring diagram using the same layout and components as the M.E.W. cct., which I found very easy to follow and wire up? 4 Blackthorn Way, Verwood, Dorset, BH31 6TA.

I wish to purchase a 12 volt DC electric motor with a max 60 rpm. I have made a model windmill approx. 5ft. tall and was hoping to make it a working model. Tel. 081 592 8623 (Essex).

I have recently acquired an E.W. lathe in exceedingly good condition, complete with a set of gears which I understand are for use in thread-cutting. By coincidence, I bought my first copy of *M.E.W.* this week; I was pleasantly surprised to see references to the E.W. lathe in the article on Alan Cambridge's workshop and the two letters printed at the end of the article. My lathe has the original J.F. Stringer plate pinned to the tailstock end of the bed.

As I have no engineering training, but would like to be able to use the lathe during my new-found retirement, I would be most grateful for any helpful information on the use of this lathe. For example, is there a set of tables available showing which gears should be used for different threads, and could someone recommend a useful book suitable for a complete beginner (a 60+ novice)? I have used a wood-turning lathe for some years, but engineering will be a whole new world for me.

Any assistance will be greatly appreciated. Tel. 0275 853796.

How interesting to read the letters from readers under the heading *Backlash* in the August/September 1993 issue of *Model Engineers Workshop* magazine.

I subscribed to *Practical Mechanics* magazine during the war and up to the last issue and still have most of them. I also have a number of pre-war copies including the first issue.

Some years ago I almost completed the model paddle steamer engine described therein, but unfortunately I lost the magazine. Details for the construction of the paddle steamer were given in the issues November 1954, December 1954 and January 1955; it is the December 1954 copy that is missing. If anyone could sell, lend or copy the article for me, I would be extremely grateful. Tel. 0753 869098.

For sale: Heavy duty vertical slide, £50. Tel. 0767 31 3164 (Bedfordshire).

I have for sale two 9in. diameter chucks. One is a 3-jaw S/C and the other one is a 4-jaw independent.

I will accept £40 for both, or swap for Cowells accessories. Please ring 0533 893044 for details (Leicestershire).

A micrometer adjusted Height Gauge complete with box of standards, all in fitted wood case. The gauge can be used either in the manually adjusted mode for quick use, or for more precise measurements, by using the integral micrometer screw. The scriber is of the conventional chisel edge type, typical of accurately adjustable height gauges. Price £27.50 inclusive of packing and carriage, returnable should the purchaser not be satisfied (U.K. only). 0962 880475 (Winchester, Hants.).

Link Up - how it works and conditions for using the feature - a note from the Editor

Requests should be written exactly as intended to be published and marked Link Up, additionally, place name and address at top of page.

Comments to the editor on the subject of the Link Up request, or other subject, must be in a separate accompanying letter.

There is no limit to the length, however, keep please it brief. In the case of a request for help with an old machine of uncertain make, a photograph may be provided for publication. (Original will not be returned).

The letter must contain for publication, telephone number and/or address. Please make it clear, exactly what you want us to publish.

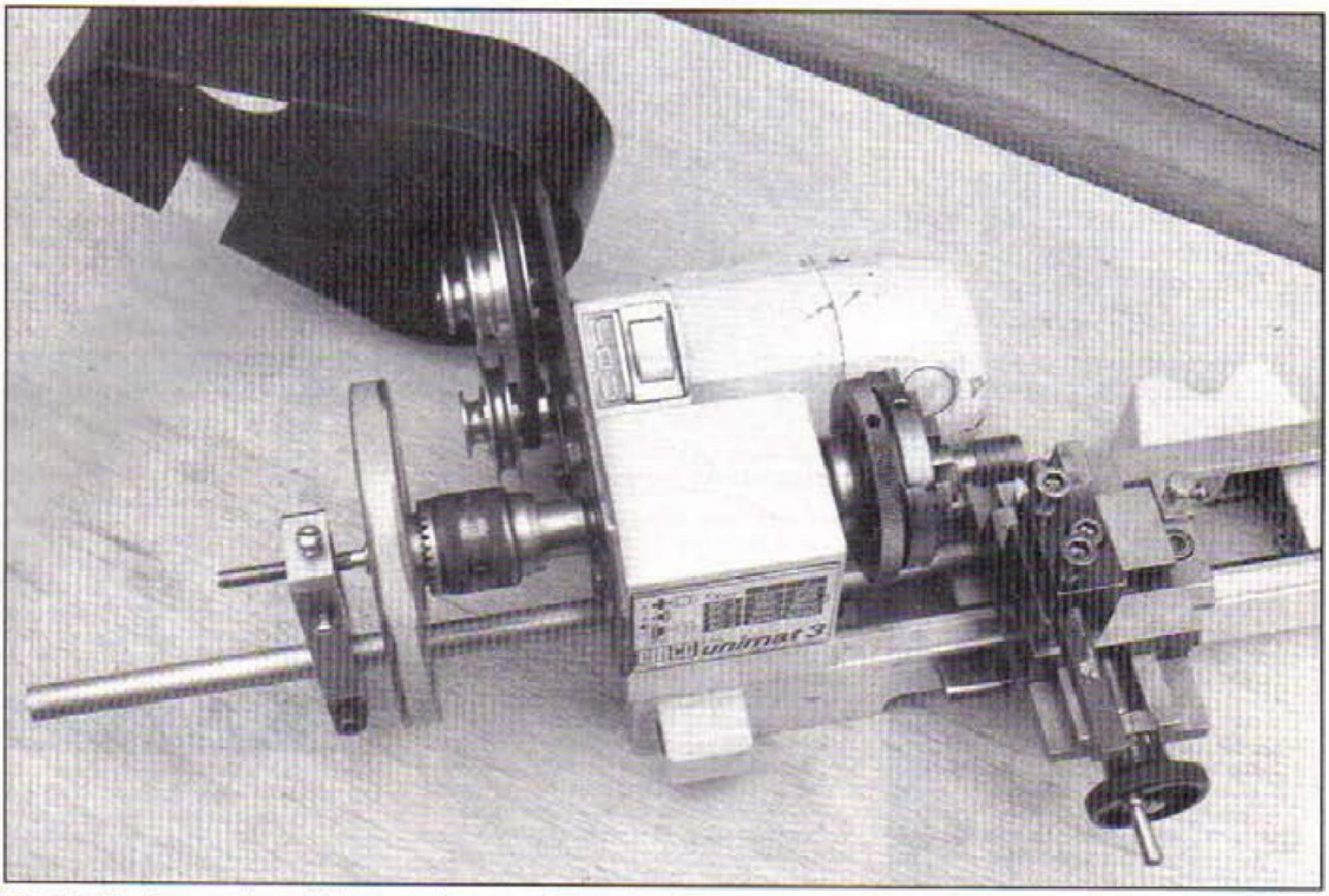
Only in the case of communications between countries where the cost of a phone call may be prohibitive, and an address has not been given, letters will be redirected as follows. Replies should be sent in a sealed and stamped envelope, marked with the name of the recipient, and an accompanying note, marked for the attention of the editor, referring to *Link Up* and quoting the issue in which the item was published.

In the case of items for sale, up to five items can be included providing descriptions are brief, total value must not exceed £50.00. Similarly, the probable value of wanted items, must not exceed this value.

Photographs of items offered for sale will not be published.

Letters should preferably be typed, but if hand written, name, address and/or telephone number must be clearly printed in block capitals. If any doubt exists, the request will not be published.

The facility is available to private readers only.



Thread cutting for manual use. The belt guard must remain open but of course, power is off and the drive pulley has been replaced by the drill chuck.

THREAD CUTTING ATTACHMENT FOR THE UNIMAT 3 LATHE

Unless you have a quick change gear box on your lathe, setting up the gear train to cut a thread can be a tedious operation, probably to the point sometimes of avoiding the job altogether. If you have one of the smaller lathes, it may not even have been supplied with the gears, and these will have to be purchased as an extra.

J. H. Frost has made an attachment which avoids the requirement to use the gear train, by the use of a follower system. The attachment, made for a Unimat 3, could surely be adapted for use on other machines including much larger ones.

While the necessity to carry out screw cutting on the lathe may not arise very frequently I have, from time to time, reluctantly, decided not to attempt to make an accessory for the machine because it required to be threaded to fit the headstock spindle or tailstock. I was constantly irked by this handicap and gave considerable thought to try to overcome it. The reason for fitting a chuck to the pulley wheel end of the spindle now escapes me. It certainly accomplished nothing but, nevertheless, from tinkering in this way I developed the basic idea from which this device was started.

It occurred to me that a bolt, held in a chuck in that position, cold control the saddle in place of the lead screw. A nut, threaded onto the bolt and prevented from turning, would travel away from the headstock if the spindle was revolved as for turning. If this movement was transmitted to the saddle it would be drawn towards the headstock and a tool in the toolpost would cut a helix along a workpiece held in a chuck in the working position. I could see that a rod could pass through the space between the headstock and the lathe bed to connect with the saddle. A link would have to be devised between the nut and the rod so that, as the nut moved, it drew the rod and the saddle along. The principle is by no means original but my problem was to make it work in accordance with the theory.

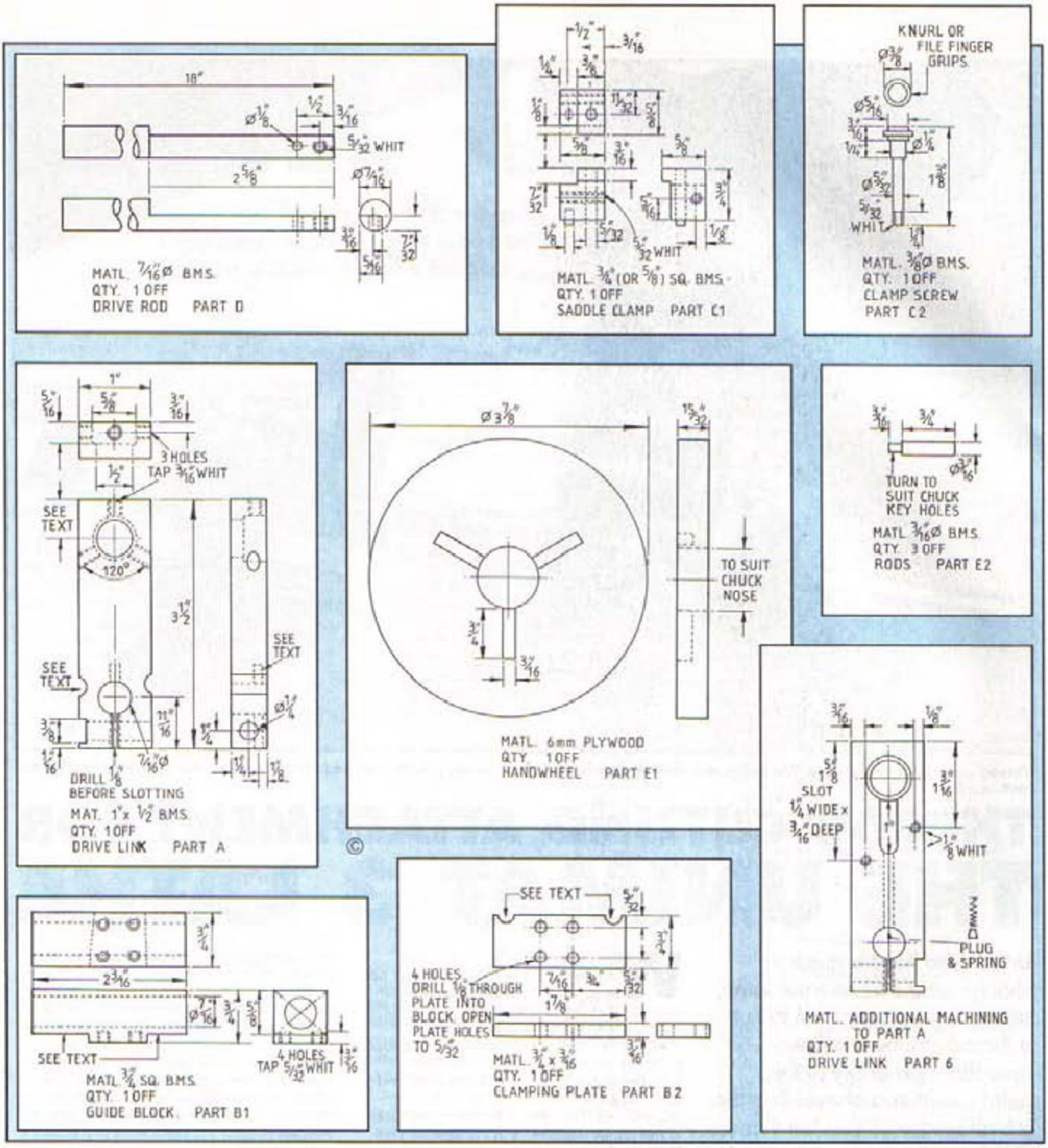
I experimented with odds and ends and satisfied myself that the device could be made to work. I realised that, with a chuck in the position normally occupied by the drive pulley, there was no possibility, initially of motorising the attachment. A wheel, for manual operation, had to be devised, but once the capability of cutting threads existed the initial nuts and bolts could be exchanged for purpose built leaders and followers that permitted the used of the motor.

Construction

To ensure correct operation of the device it is essential that its alignment is as near perfect as possible. In order to attain this, work on the drive rod and saddle clamp is carried out in conjunction with the alignment operation and neither part can be completed out of sequence.

The drive rod (part D)

This is simply a length of 5/16in. BMS round rod with a little shaping at one end. A length of eighteen inches would enable threads to be cut in any position along the length of the lathe.



The saddle clamp (Part C)

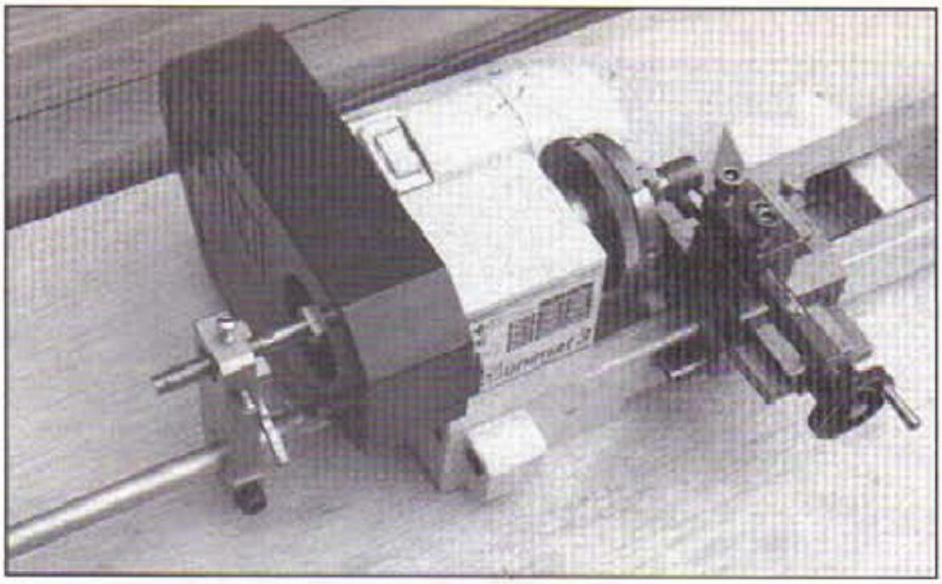
I made this from a piece cut from ¾in. x ¾in. MS bar. I shaped the block with hacksaw cuts and filing. Drilling the holes should present no problem as it is a convenient shape to secure on the drill table. However, holes should only be drilled in conjunction with the alignment operation. I turned the vertical screw from ⅜in. round rod and filed indents in the knob to act as finger grips.

The drive link (Part A)

Before the holes at the top of this part can be drilled the guide block and drive rod must be in situ, as their position will establish the centre of the large hole. At an early stage, before the clamping slit is made in the bottom hole it is suggested that a ⅛in. dia. hole is drilled, as shown on the drawing, to sufficient depth for the end to be a little beyond the top of the clamping hole. It is needed if an improvement is to be made at a later stage and difficulties could arise if it was drilled through the clamping slit.

Drilling the drive rod hole and the hole for the clamping bolt should present no problems. I used an M6 socket head screw and a nut set in a recess filed in one side of the bar to exert the clamping pressure. I had it in mind that the link would need to be reversed if left hand threads were cut and another recess on the opposite side of the link would enable me to keep the screw head at the front of the lathe. I found that considerable effort was needed to obtain a firm grip on the drive rod and filed metal away from each side of the hole with a half round file which eased matters. I used two blades in the hacksaw when cutting the slit, a tip from an article previously published in this magazine.

A centre line was scribed on the face of the link across the position that would be occupied by the top hole. A drill chuck holding a short scribing point was screwed onto the pulley end of the spindle and the link was slid onto the drive rod. Swivelling the link against the scriber caused an arc to intersect the centre line at the centre of the top hole. The positions of the three clamping screw holes were marked out from this centre. I drilled the large hole in stages to ½in. dia. and opened this out, to a limited depth, to ⅝in. with a boring bar. The shoulder that this method leaves is important, as it gives support to a nut when pressure is exerted against it during thread cutting. In addition a washer can be placed against it to support small nuts that would otherwise fall through the hole. Any alternative method of construction to avoid using a boring bar should take this into account. Two of the three holes that break into the large hole could present problems owing to the angle at which they are set. I was able to use the drill and milling attachment, drilling first at right angles, just to the depth of the drill point, and centre punching into the sloping side of the indent. I then set the drill at an angle of 30 deg. from the vertical and clamped the workpiece to the cross slide so that the drill fed into the punch mark.



Set-up for motorised use. The belt guard is closed as for normal lathe operation.

The handwheel (Parts E)

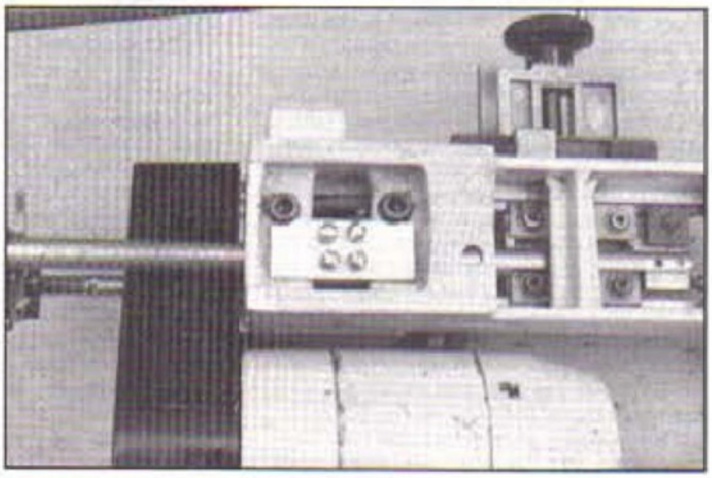
I made this from thick plywood from which I cut two discs each 3¾in. diameter. In the centre of each disc I cut a hole to a stiff push fit on the nose of my drill chuck. Three round rods were cut and the ends reduced in the three jaw chuck just to fit into the chuck key holes of the drill chuck. With these rods set in the chuck key holes the chuck nose was pushed through the hole in one of the discs until the rods were in contact with the wood.

Their shapes and positions were marked on the disc and slots cut to a tight fit with the rods. Only one disc was treated in this way so that when the two were placed together the result was a disc 12mm thick with three grooves to a depth of half that thickness. The discs were spread with a cool water Casein glue and all the parts assembled together. The assembly was set in a vice as far as the drill chuck would allow and two battens clamped above the chuck with a G clamp until the glue had set.

The guide block (Parts B) and general alignment

The block itself is made from square steel bar. It should be cut a little over length and brought to it true dimension by facing the two ends. One side of the bar should be selected as the base and a line ¼in. distant from it should be scribed right round the block on the two adjacents sides and the two ends. This will have divided each end into two rectangles and scribing lines across opposite corners of the large rectangle on one end will position the centre of the guide holes at their intersection.

Since I made the guide block I have seen warnings in this magazine's pages about the dangers of drilling large holes to their full diameter and opening out holes with a sharp drill. I started with a ¼in. drill and opened out the hole in stages, to finish with a brand new 7/16in. drill. I carried out the work on the lathe, the four jaw chuck held the workpiece which meant that, when drill sizes exceeded the drill chuck capacity, the three jaw chuck had to be used on the tailstock. My three jaw chuck is suspect and, for one reason or another, I found the finished hole to be a little oversize. I have accepted it but now believe that greater accuracy would have resulted from the use of a boring tool during the final stage. Before further progress could be made to shape the block its position on the casting had to be established.



The underside showing how the clamping plate is positioned and how the drive rod passes beneath the saddle.

Move the saddle to the headstock end of the bed. Free the machine from any base to which it may be mounted and remove the drive pulley, the motor and the fine feed attachment if fitted. Loosen the grub screw beneath the tailstock leadscrew housing and wind out the leadscrew, turning it clockwise.

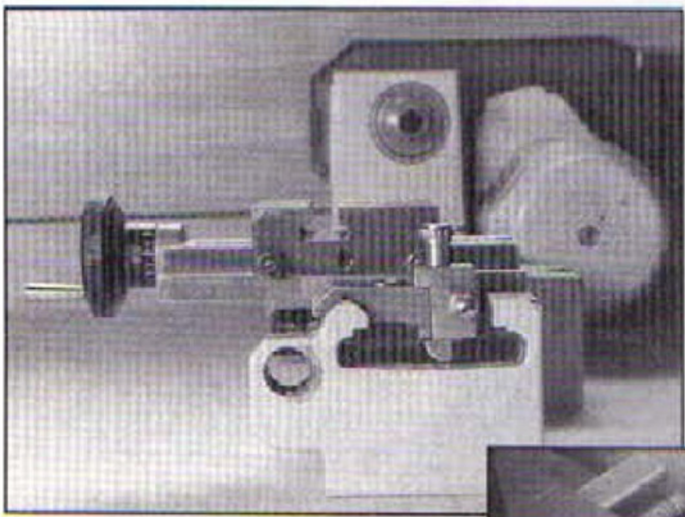
There is just room to slide the guide block into the gap between the headstock and the bed. Two unmachined cross members of the bed casting support it, one at each end and it is the unevenness of this foundation that causes alignment difficulties. It should be positioned so that neither end projects outside the headstock and the hole is directly below the spindle. The bed should be marked with a fine, indelible, fibre tipped pen, or a pencil, to show the position of the ends of the block. The headstock should now be taken off by removing the two holding screws accessible from the underside of the lathe.

The block should be repositioned against the marks and kept there whilst the lathe is turned on its back. This can be accomplished by using the two holding screws just removed, leave the spring washers on these screws in place. Obtain two flat washers of about ¾in. dia. with holes that will allow the screws to pass through, two M6 nuts will also be required. Pass one of the screws up from beneath the lathe. Slip a washer over the screw, followed by a few turns of one of the nuts. Repeat the process with the other screw and position the two washers so that they rest partly on the front bearer and partly on the block. Hand tighten the nuts, no great pressure is needed, and, during this process, manoeuvre the block to sit within its marks.

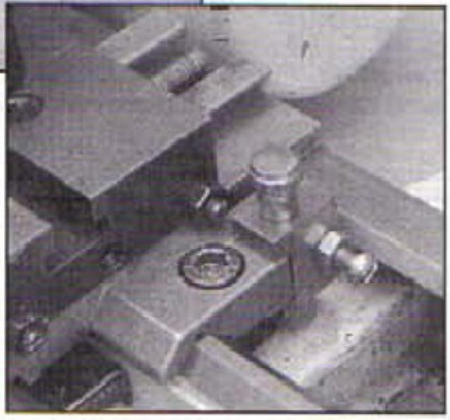
When the lathe is turned over it is possible to see the base of the guide block. Running a felt tipped pen along the sides of the cross members will mark the sides of the area of the block that is to protrude between them once the block is shaped. Place the clamping plate **(part B2)** directly over the block, its ends equidistant from the sides of the box like casting in which it is to be housed. Two recesses must be made in one side to clear the heads and washers of the headstock retaining screws. these can be marked and cut, a round file will do the job, and the blank replaced to check that it can be properly positioned. Its sides should now be marked at the places where they are intersected by the cross members. These marks can be joined across the plate to replicate the area already marked on the guide block.

Before turning the lathe back onto its base examine the underside of the saddle. Two plastic rectangles help to hold the saddle to the lathe bed and the drive rod **(Part D)** must be shaped to avoid the screws and washers holding the one that slides along the bottom of the rear bearer. To assist this make a mark on the headstock side of the saddle to indicate the position of the innermost extent of the washers.

As the drive rod passes beneath the saddle it bears against a spine of metal that runs along the centre, and is part of, the saddle casting. The end of this spine can be seen projecting beneath the saddle when viewed from the headstock end. On my



Two views showing how the saddle block and drive rod tail fit around the saddle casting.



machine the drive rod aligned properly with the metal spine when it was spaced ¼in. from the rear bearer. In fact I used the shank of a ¼in. drill to run between the rod and the vertical face of the bearer to check that it was correctly positioned and parallel with the lathe bed along its length. I checked the height of the drive rod in relation to the bed by placing the depth gauge end of a vernier calliper on the edge of a steel rule set upright across the two bearers and lowering the pointer of the depth gauge down to the top of the rod. The result of a test at one end was checked with the height at the other end to make sure that the rod was level. As an indication of height my reading was 3/32 inch.

With the lathe back on its base remove the headstock bolts from their temporary use and put them aside. Put the block on its marks and pass the bar, from which the drive rod is to be made, through the block until the block is at its centre and is in balance. If the bar tilts in relation to the saddle bearers place shims or feeler gauges beneath the lower end of the block until this is corrected. A line should be scribed across the low end of the block, at a distance equal to the shims or gauges, below the line previously scribed around the base.

Consideration can now be given to drilling the holes for the clamping screws. I used four screws because of the small amount of metal available to hold them. The holes for the screws should be marked on the clamping plate in the area of the block protuberance already marked. They should be situated as close to the sides of the plate as possible, leaving just sufficient metal to support the screws. The plate and the block should be clamped together so that the cross member marks on the block lie directly beneath those on the plate. Care must, of course, be taken to drill to the exact depth to avoid breaking through into the drive rod hole. The holes in the plate are then opened out to clearance size and those in the block tapped as required. I drilled to a depth of only 3/16in. into the block, and flattened the bottom of the holes with an end mill, finishing the tapping with a plug tap ground flat to the start of the threads. With such a small amount of thread I decided to use screws, with nuts screwed up close to the heads which, on assembly, could be run down the screw to provide the clamping pressure. The block is first set in position, the screws are threaded through the clamping plate and casting and are screwed tightly into the block. The nuts are then tightened against the clamping plate with a tubular spanner. Using this method enables the block to be fitted or removed with the headstock in place which would not be possible if studs were permanently set in the block.

Final shaping of the block can now be carried out with the removal of metal from the underside of each end of the base. First cut across the base of the block along the lines marked from the cross members. These may not be straight but straight cuts are all that are necessary and should be made so that no part of the line is left on the centre section. This will result in a very loose fit between the cross members which will be corrected later. Sawing along the base, from each end, to the cuts just made will enable the unwanted material to be removed. Cut to the waste of the scribed line, ensuring that allowance is made for any tilt that may have been evident in the earlier check. It is easier to correct this by leaving metal at the low end than to file it off from the high end after cutting. It must now be worked upon with a file until it stands firmly on the cross members. I found it necessary to take only 1/32in. off the part that rested on the cross member nearest to the tailstock but 1/16in. off the part resting on the other cross member.

When the block is sitting correctly with the clamping plate, with lightly tightened screws in place, the drove rod bar can be inserted to align the block accurately. The block should be positioned so that the end of the bar, whilst running parallel with the bed, meets the saddle at the point where the end of the metal spine can be seen. Almost all of the base of the spine should be covered by the face of the bar, no more than a small corner of the bottom of the spine, nearest to the front of the lathe, remaining visible. The height of the bar should be such that the centre of its face is level with the bottom of the spine. Should it be found that the configuration differs significantly from that described above additional work on the guide block may have to be undertaken to correct it.

Two pieces of metal must be removed to shape the end of the bar to almost a quadrant. First mark out the metal that must be removed to allow the bar to pass beneath the spine under the saddle. Pass the bar through the block and check the marking against the bottom of the spine. Cut well to the waste of the marks and mark out the piece that must be removed to avoid the screws beneath the saddle. Again insert the bar and check against the mark made earlier on the saddle side. After making the final cuts, it is simply a matter of filing and testing until the rod passes beneath the saddle, in contact with the spine, and without fouling the holding screws.

Looking from above the saddle the tail of the drive rod can be seen emerging along the back of the projection that carries the saddle adjustment screw. A mark should be made along the tail using the back of this projection as a guide. The centres of the two holes that must be drilled in this part of the rod lie on a line midway between the mark just made and the rounded side of the tail. Their distance along the bar can be marked out from the drawing and I used a ⅛in. drill for both holes, one to be tapped 5/32in. BSW later. These holes can be used to position those required in the saddle clamp block **(part C1)** by clamping the two parts together. A good fit is essential here so the block should be offset a little towards the rounded edge of the rod to leave a little metal to be filed away to conform to the side of the saddle. The same drill as was used for the holes in the rod is used; one hole is drilled 3/16in. deep and the other right through the block to be opened out to clearance size for the vertical screw. The stopped hole is for an alignment pin which is simply a short piece of ⅛in. rod set in with adhesive; do not, however, make it a permanent fixture until the block sits correctly. If the block is too high metal can be filed from the bottom, if too low the underside of the overlap can be filed. The horizontal hole should present no problems and should be drilled and tapped so that, when inserted, the screw impinges on the saddle about half way up its side.

When the saddle clamp is in place the vertical screw should simply hold the drive rod against the spine beneath the saddle and the clamp itself firmly on the top of the saddle. The clamp may tilt clear of the saddle if the drive rod is rotated but setting the horizontal screw against the saddle and locking it with the nut will, to a small extent, act as a brake to this movement. However its function is to prevent any play between the drive rod and the saddle and it should, therefore, be tightened only until

SURPLUS SIMILARITIES

When buying surplus or second-hand taps and dies, if NF or NC threads are encountered, these are essentially the same as corresponding UNF or UNC threads with the exception of 1in. NF which has 14 tpi whilst 1in. UNF has 12 tpi.

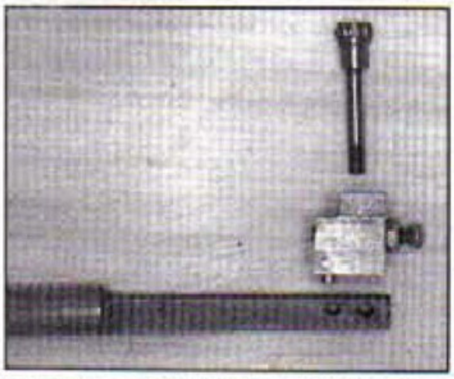
Alan Jeeves

all slack is taken up. In use the drive rod cannot rotate, so the arrangement is quite adequate. The vertical screw is tightened with the fingers alone and it should be possible to remove the saddle clamp and replace it without using any tool or adjusting the horizontal screw. Neither the alignment pin nor the vertical screw should protrude below the drive rod as they could foul the casting as the saddle is drawn along the bed.

The alignment may now be tested by sliding the saddle up to the headstock and back to the tailstock. Movement should, of course, be discontinued in the event that firm resistance is felt.

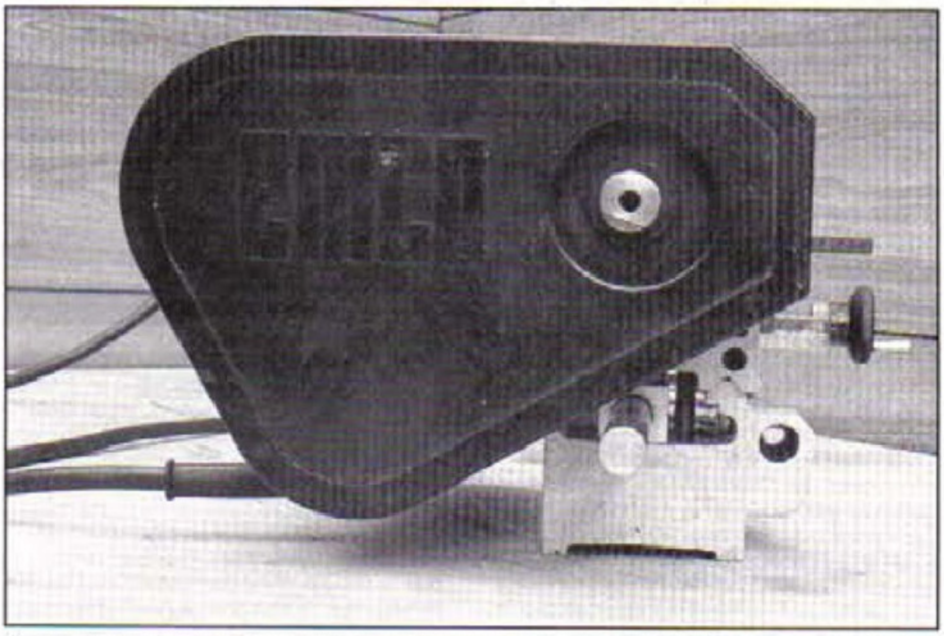
Once the system has been accurately aligned the guide block and clamping plate may be properly seated on the bed casting. Make sure that the final position of the block is clearly marked on the casting and dismantle the assembly. Give the tops and bottoms of the two cross members a light spray of WD-40 or a light coating of thin oil and cover them with Clingfilm. Cut two rectangles each about the same length as the cross members and a little over twice the width. Push about half the width of a piece through the gap in the bed and fold the material back across both the top and bottom surfaces of one of the cross members. The Clingfilm can be smoothed out and will adhere to the oily surface. Repeat the process to cover the remaining cross member.

Arrange the guide block and clamping



The drive rod tail with the saddle clamp and vertical screw.

plate so that they are correctly orientated for reassembly. Mix a little two part, car body filler paste, I used Plastic Padding Chemical Metal (hard), and spread it on the parts of the block and the plate that come into contact with the cross members. Only a thin layer is required on the flat surfaces, a little more at the inside corners and projecting edges of the guide block. While the paste is still soft assemble the parts to the machine, leaving the nuts fairly loose, and fit the drive rod and saddle clamp. Manoeuvre the block onto its marks and, holding it firm, push the saddle up and down the bed. Slowly tighten the nuts, taking care not to allow the block to move off its marks and, from time to time, running the saddle along the bed to ensure that alignment is maintained. When the compound has set the parts can be removed and it will be found that the Clingfilm strips away quite easily. Surplus compound can be trimmed away and the components should fit back into their working positions quite accurately.



This end view shows how access is available to the mandrel boss, and the position of the guide block within the drive casting.

Using the accessory

When I took the device into use I experienced many disappointments before cutting an acceptable thread. These, however, resulted from my total lack of experience, and some carelessness, rather than from faults in the equipment. However, I am not yet experienced enough to discuss the finer points of screw cutting and must content myself in running through the procedure that gives me acceptable results.

I have concentrated on metric threads because all the threads on the Unimat 3 are cut with a 1mm pitch and because it is very easy to calculate the size of the hole in which to cut internal threads. This is simply the bolt diameter minus the pitch. To cut a thread in, say, a die holder to be screwed onto the 14mm diameter by 1mm pitch tailstock mandrel the hole to be threaded is 14 – 1mm = 13mm. It seemed reasonable to commence with attempting to cut a bolt with a 1mm pitch which could be checked for accuracy with a suitable internal thread. I acquired a cutting tool with a sixty degree point and a 100mm long M6 x 1mm bolt with about 30mm of unthreaded shank. A nut to run on the bolt and actuate the drive rod completed the requirements. The head should be cut from the bolt and the bolt then spun in the drill chuck to make sure that it runs true.

A suitable starting point would be the cutting of a short length of M14 x 1mm thread. I have found it easier to cut threads on fairly large diameters than on small ones and this piece has the advantage that it can be used to test internal threads being cut for attachments to be fitted to one or other of the mandrels.

A piece of rod about 40mm long should be set into the three jaw chuck as far as it will go. It should be turned down to 14mm, the end faced and a small chamfer turned around the diameter. A groove about 1mm deep may be cut fairly close to the chuck to provide a resting place for the tool at the end of the thread. When cutting a thread there is considerable pressure towards the chuck and, unless steps are taken to prevent it, the workpiece could be forced towards the mandrel which would result in a misshapen thread. The size of our rod and setting the end to the back of the chuck takes care of this, and the chamfer provides the tool with an easy ride to start the cut. The groove at the end of the cut provides an exit for the tool, though it is not always possible to arrange. Once it is certain that the workpiece has been completed the lathe can be converted to the screwcutting mode.

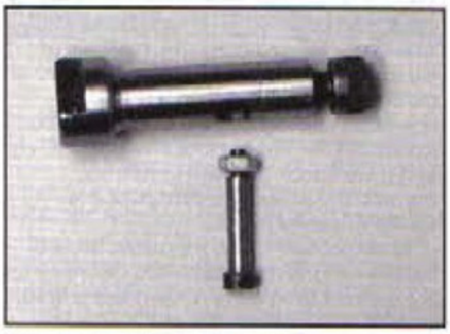
Remove the saddle leadscrew and the drive belt and pulley. The motor may be left in position but the guard door should be fully open. Screw the drill chuck onto the spindle and use the chuck key in one of its holes to tighten it on the mandrel whilst gripping the three jaw chuck with the other hand. Put the M6 bolt into the chuck and tighten the jaws firmly. Thread on the nut with a drop of oil and run it up the bolt by spinning the spindle, clearing any obstruction should it not run freely. Assemble the handwheel by pushing the short rods into the chuck key holes and pushing the wheel over the chuck nose. Pass the drive rod through the guide black and under the saddle, secure the saddle clamp and adjust out any play between the drive rod and saddle. Ensure that the horizontal screw is just tight enough to remove any play and is locked with the nut.

Slacken the saddle adjustment screw to allow it to run fairly freely and run it up and down the bed to check the alignment. The tool post should be set along the left side of the cross slide and a cutting tool with a 60deg. point secured at centre height at right angles to the workpiece. Because only a small nut is being used a washer with a hole large enough to allow the M6 bolt to pass through, must be pressed up against the shoulder of the drive link top hole. The drive link may then be slid along the drive rod with the bolt passing through the top hole. Position the nut sufficiently away from the drill chuck to facilitate adjusting the nut holding screws and, with one of the nut flats horizontal on top of the bolt, move the drive link until the nut is within the hole and firmly against the washer. Moving the handwheel back and forth, tighten the top screw until resistance to free movement is felt from the handwheel. Turn the screw back until resistance is eliminated and repeat the process with the other two screws. It is most important that these screws centralise the nut whilst, at the same time, holding it very firmly. Turn the handwheel clockwise until the drive link is about 15mm from the drill chuck, position the saddle so that it is sufficiently to the right of the workpiece to allow the hole in the small faceplate to be placed against the workpiece end. This is to provide the means of checking for a fit as the work proceeds. Tighten the clamping bolt on the bottom of the drive link to prevent it from moving on the drive rod. With the tool retracted from the workpiece, try a dummy run by turning the handwheel to draw the tool as far as the groove near the chuck. Reverse the handwheel and run the tool back to a position where the small faceplate can be inserted between it and the workpiece. Check that the nut is still in place against the washer and is firmly held by the clamping screws.

After any problems revealed by these checks have been overcome the first cut can be made. Position the tool close to the end of the workpiece and advance it until it is just in contact. If you think you have applied too much pressure on the workpiece withdraw the tool and advance it again; withdrawing it only slightly will result in cross slide backlash problems. Move the tool just to the right of the workpiece and turn the cross slide wheel clockwise until a division mark lines up with the mark on the casting. Apply some lubrication to the workpiece, ordinary lubricating oil will help if a proper cutting compound is not available. Note the setting of the cross slide dial and turn the handwheel towards you until the tool has traversed to the groove. Hopefully it will have traced a helix along the workpiece.

I have fallen into a routine to reposition the cutter which may be found useful. I withdraw the cutter by making a full turn of the cross slide leadscrew wheel leaving it at the same setting as was used for the cut but withdrawn by 1mm. Whilst turning the handwheel to move the tool back to the start I give the workpiece a brush with a small nail brush to clear away metal fragments. I made a quick check to ensure that nothing has come loose, paying particular attention to the nut in the drive link and set the new cut. The cross slide dial tells me exactly where I took the last cut and a full feeding turn returns me to that position after taking up any backlash on the leadscrew. For the second and third passes cuts of 0.1mm may be set but after that, for mild steel in any case, cuts will probably have to be reduced to 0.05mm. Brass or alloy could possibly accept deeper cuts but these settings must be found from the feel of the job as it progresses.

After having advanced the tool a total of 0.6mm it should be moved as far to the right as possible to enable a fit to be attempted with the faceplate. The thread may just start to engage but, of course, no attempt should be made to force it. The faceplate is of alloy so it will be the thread in the faceplate that suffers but, more probably, the workpiece will twist in the chuck throwing everything out of kilter. Should you not have a small faceplate a fit must be attempted with some other item that screws onto the mandrels. Move the saddle clamp and move the saddle along the bed until there is room to attempt the fit. Afterwards, move it back and replace the saddle clamp. This manoeuvre must almost always be carried out when cutting internal threads. Provided nothing else is disturbed the tool should engage the thread when a new start is made; however I always make the next pass at the old setting and check that the thread has been correctly picked up. Should at any time the tool lose synchronisation with the thread it can be reset by loosening the toolpost and repositioning it with the tool point in contact with the thread being cut. This will result in a different setting of the cross slide dial, and, in any case, should only be resorted to in emergencies. Hopefully the current project can be completed simply by gradually increasing the cut until a fit is reached.



The mandrel boss assembly.

Internal threads are cut in much the same way, using a cutter small enough to pass through the hole being threaded. I prefer to fit the tool upside down in the tool post and cut into the far side of the hole. I can see a little better what is going on, and set the cut in exactly the same way as for an external thread, rather than having to reverse the leadscrew rotation when setting the cut to the near side.

Most of the difficulties that I have encountered have resulted from the need to turn the handwheel clockwise to reposition the tool after a cut has been made. It is, in itself, a tedious business, but it also reverses the normal forces which tend to tighten the lathe components and can cause looseness which can spoil a thread. I decided to try to eliminate it and, at the same time, enable the lathe motor to operate the system.

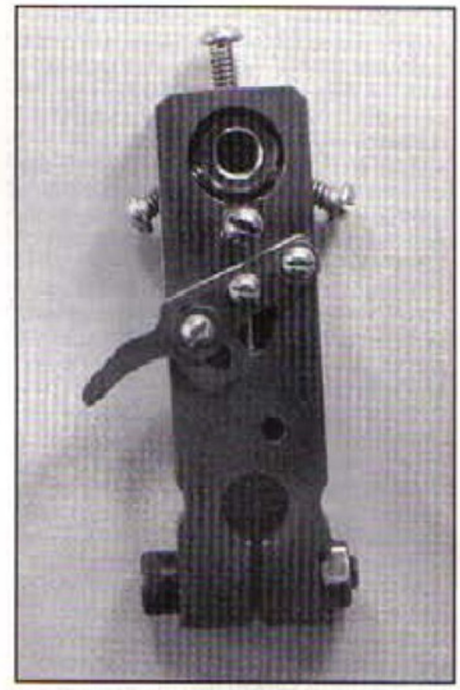
QUICK TIP

When mounting a large or irregularly shaped workpiece on a faceplate or in a four jaw chuck, rotate the job slowly one full turn by hand before starting up to ensure that the slide and tools are clear of the work, and also to see that the work doesn't hit the bed. Repeat this exercise every time the workpiece is adjusted or tools are changed.

David Dumble

Final version

The nut and bolt used to control the pitch of the thread being cut are substituted by a leader **(part F2)** and follower **(part F3)** which can be cut by the manual process just described. These items can be made from mild steel or brass and the leaders have their ends threaded so that they can be screwed into a boss **(part F1)** fitted to the end of the mandrel. I leave a short length of plain shank in addition to the threaded end so that I can continue to use them in the drill chuck if I wish. The followers are attached to a slide **(part F4)** on the drive link **(part F6)** which engages them in or disengages them from the thread of the leader, dependent upon its position.

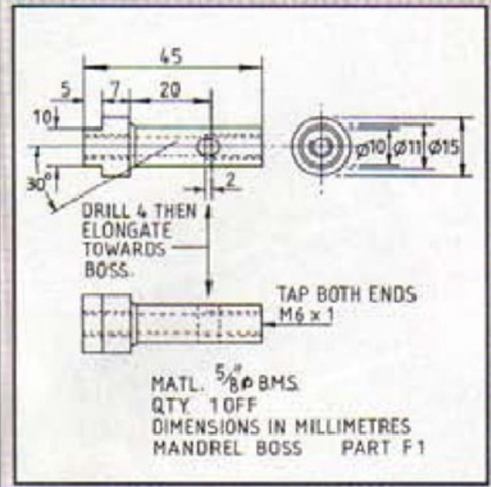


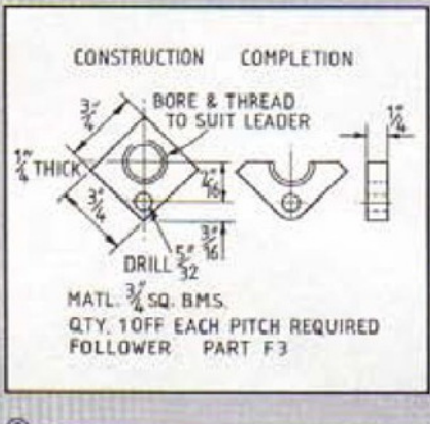
The drive link holding a solid M8 nut.

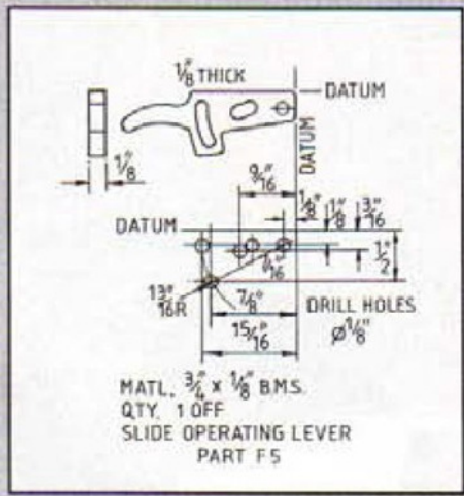
An end mill is used to cut the groove in the drive link along which the follower slide operates. The ⅛in. hole started from the bottom of the link should now be continued until it breaks through the end of the groove. The slide should be cut as a solid rectangular block, the stem can then be turned in the four jaw chuck. A small punch should be made from ⅛in. hard steel, piano wire would be suitable, and used to mark the centre of the stem. The blank will fit into the slot with one end against the top of the upper hole of the link. The punch is inserted in the ⅛in. hole and given a tap to mark the bottom of the blank. This mark is then centred in the chuck and the stem turned to its correct length and diameter. With the slide set in its groove the stem should fit into its hole and allow free movement of the slide up and down. I used part of a spring from a disposable cigarette lighter held in place by a short slightly tapered brass plug forced into the bottom of the stem hole.

The slide operating lever **(part F5)** is made from ¾ x ⅛in. steel. Mine remained as ¾in. bar until I had drilled the holes, cut the slots and made sure that everything worked. I then cut it to its final shape. I have drawn a grid to help mark out the principal holes though one or two more will help to cut the long slot. It is a fairly simple drilling and filing operation.

Making the mandrel boss should present no difficulties as it is straightforward lathe work. It slips into the mandrel from the pulley wheel end and is held in place by a bolt passed through the tommy bar hole. An Allen key is inserted from the chuck end and engaged in a socket headed screw.







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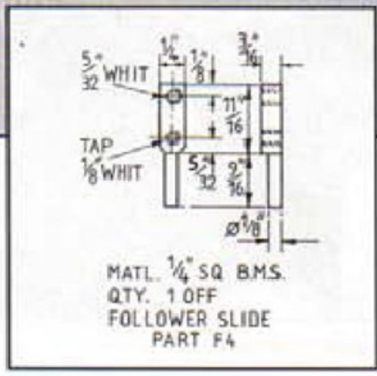
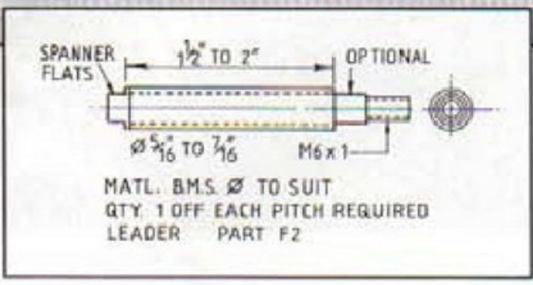




Some leaders and followers.

Tightening this draws the boss hard against the mandrel and it is centred by the taper turned on its inner face. It is important that a socket headed screw be used and that spanner flats are filed on the boss itself as otherwise difficulties could be encountered in its removal. The screw should be tightened just enough to firm up the boss in the mandrel and, should it not come free when the screw is loosened, a light tap on the Allen key should be sufficient to release the taper.

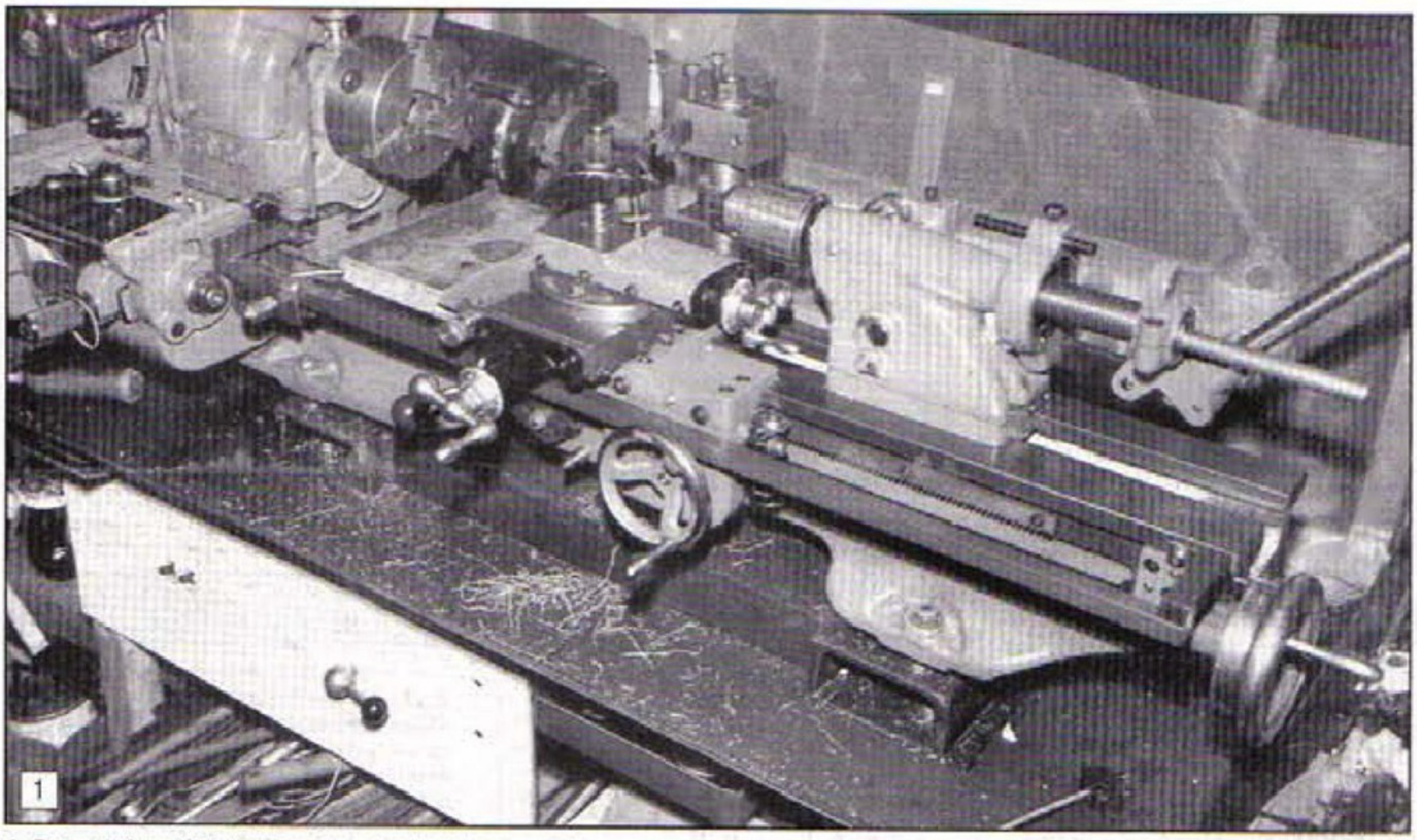
Dimensions on the drawing of this particular item **(part F1)** are in millimetres because it must be a close fit to the machine, which was built to metric specifications. I used the three jaw chuck and, to preserve concentricity, carried out as much of the work as possible without removing the workpiece, the end of which was supported by a centre. The spindle was turned first up to the start of the taper and as the desired diameter was approached the centre was removed and the tailstock mandrel brought up to the piece to test for a fit. When this was achieved the chuck, still holding the workpiece, was removed and a test made at the pulley end of the headstock mandrel. The chuck was replaced and the inner face of the boss machined and the taper formed between it and the spindle. Checks were made until the taper permitted the boss to bear against the end of the mandrel but would not allow any lateral movement. The workpiece was then drilled right through whilst still in the chuck with a drill held in the drill chuck on the tailstock. I used a 5mm drill as I intended to use an M6 x 1mm screw to tighten the boss in the mandrel and to use the same thread on the leaders that were to be screwed into the boss. Other available threads of close to ¼in. dia. could be substituted but it is obviously simpler to use the same thread at each end of the piece. I cut the thread at the spindle end with the tap in the drill chuck, taking it in as far as the position for the tommy bar hole. The large diameter of the boss was then machined and the piece parted off a little over length. It was then reversed in the chuck and the boss faced off to a square, well finished surface and the centre hole tapped to a depth of about 10mm.

The piece was fitted in the mandrel and a mark made on its shank through the tommy bar hole in the lathe spindle. A similar sized hole was drilled through the workpiece and the diameter elongated towards the boss with a needle file. I turned up a small bolt, the same diameter as a tommy bar, and threaded the end to take a nut. This secured the boss in the mandrel and the elongated hole would allow the screw to draw it tight against the mandrel end. Finally the spanner flats were filed to a good fit with the 10mm spanner.

The improved device in use

The accessory is assembled to the machine with the drive pulley in place and the mandrel boss fitted. A leader is screwed tightly into the boss and the appropriate follower attached to the slide on the drive link. Depressing the slide lever allows the follower to traverse the leader with thread disengaged so that, at the end of each cut, the tool can be repositioned by simply pushing the saddle back to the start position. I always use the slowest speed when cutting threads but, even so, the tool traverse is remarkably fast. Depressing the slide lever will only stop the traverse and the cut will continue as a groove around the workpiece. If a groove has been provided at the end of the cut to receive the tool no harm is done, otherwise the tool must be withdrawn by a quick turn of the leadscrew wheel. Care must be taken to ensure that the traverse is stopped as soon as the tool is withdrawn otherwise the saddle could collide with the chuck. In such circumstances I switch off the machine and, if necessary, complete the last turn or two of thread by hand using a spanner on the mandrel boss. The machine must be switched off in any case whilst the tool is repositioned and the new cut set.

Having disposed of the annoyance of having to turn a handwheel back and forth, with the possibility of loosening one or other of the threaded components, we must remember that the leader is now being driven in a way that tends to loosen it from the mandrel boss. Provided there is a good length of thread at the end of the leader and it is a firm fit with the thread in the boss this should not present difficulties. However it should be well tightened and checked during the progress of the work. Thought could be given to using a left hand thread here if facilities are available. *(Why not a grub screw in the mandrel boss and a suitably positioned flat on the leader? – Ed.)*



1: General view of the lathe mounted using the support frame.

A BENCH MOUNTED SUPPORT FOR THE LATHE

In this article, Derek Walters offers his solution for mounting a medium size lathe on an angle iron frame and wooden topped bench. This he does by adding a substantial channel iron frame, thus achieving adequate rigidity.

2: General view of the lathe mounted using the support frame.

The excellent article by Bill Morris in Feb./March '92 of *M.E.W.* prompted me to think that our readers may like to know of a different approach to mounting a lathe upon a wooden bench top; even thick old timbers that are very dry will still move slightly due to humidity and temperature changes, this can cause slight distortion of the lathe bed and therefore inaccurate work is the result. This is especially noticeable when turning shafts.

I had a wooden workshop and had been plagued with this problem with my ML7 bolted down to 4x2in. timbers, using Myford raising blocks. After moving to a new location in 1970, I decided to try and solve this problem; still using a wooden workshop and easily obtainable wooden planking for the bench top, to make a good, rigid bench that was almost an integral part of the shed, then mount a rigid structure upon the bench and the lathe upon it by conventional methods.

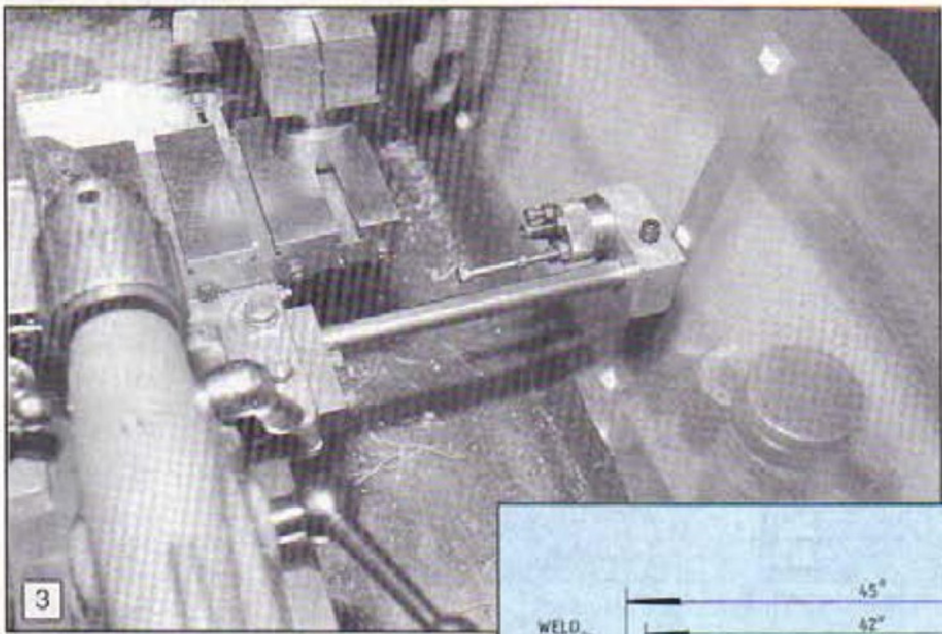
Whilst working on this I decided to part exchange the ML7 for a new ML7B and go the whole hog and mount it in a chip tray upon the new support on the new bench.

The following is a blow by blow account of how I went about this. The shed was made to my instructions by a local manufacturer and has a window stretching two thirds the length of one side, with the lathe in front of the window. 1 x 8in. T&G kiln dried deal timber can be purchased from most good builders' merchants, this is used for the bench top which is 20in. wide. The bench height is 34in. to the top from the floor, is supported by 6 bench legs as detailed in sketch spaced at 20in., each leg is screwed to wood wall framing by three screws and one screw in each foot. Two coach type bolts secure each plank to each leg and this results in a very rigid bench.

The legs are made from 1¼ × 1¼ × ¼in. (32 × 32 × 6) black angle as shown in the drawing, the triangular bits cut out are replaced as corner gussets. These gussets can be welded, riveted or pop riveted in place.

Don't finally tighten the wood screws yet, first fit the planking to the legs, ensure that the heads of the coach blots are below surface level, then check the bench top for level with a builder's level and shim up under any foot requiring it with a suitable hard material. Tighten all screws up and give a final level check. You should have a bench as firm as a church.

The chip tray as drawn is for the ML7B



3: The polythene chip screen at the rear of the machine.

QUICK TIP

If you have a horizontal milling machine this can be used to turn large diameter items beyond the capacity of the lathe. An adapter from the milling machine taper to the lathe mandrel nose fitting will allow the faceplate or chuck to be fitted to the mill and a toolpost arranged on the table as necessary. Use with care and slow speeds!

Hugh Mothersole

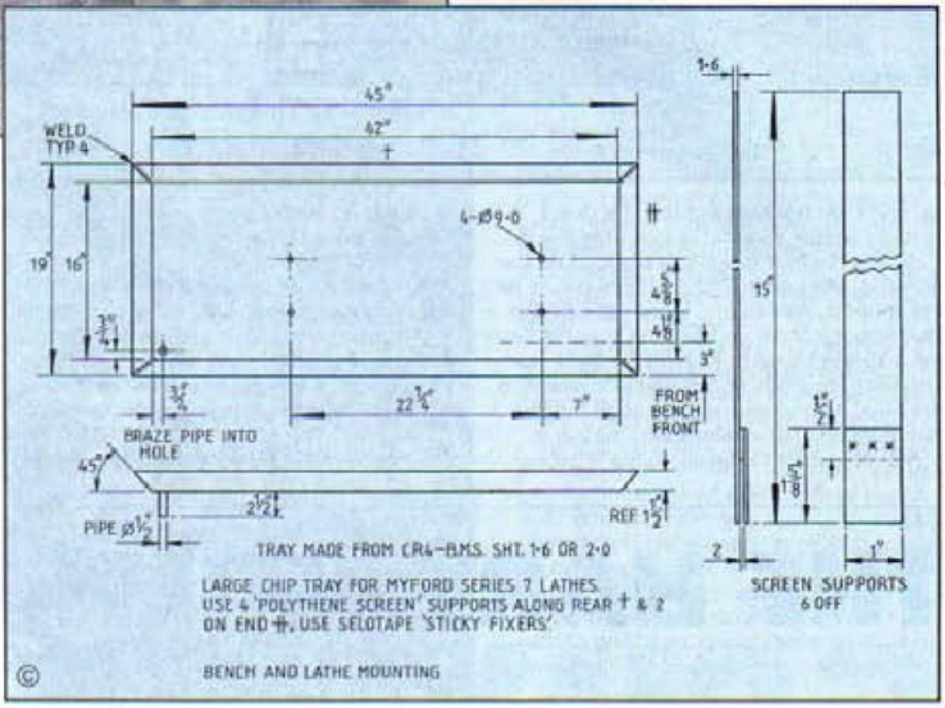
and allows for ample clearance all around. I doubt if you will have capacity to make this, so you can purchase a Myford tray, or your local sheet metal shop will fabricate one for you.

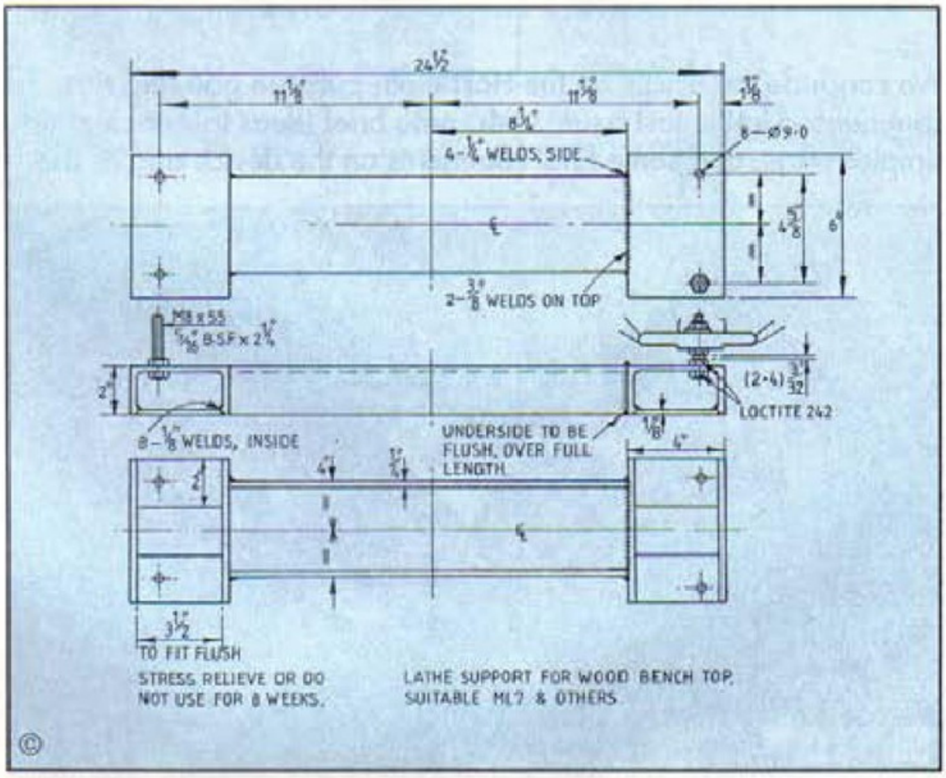
The lathe support bracket is cut from R.S. channel of 4x2 × ¼in., metric 102 × 50 × 6mm, the four lathe support studs from M8 or 5/16in. B.S.F. × 2¼in. hex. hd.

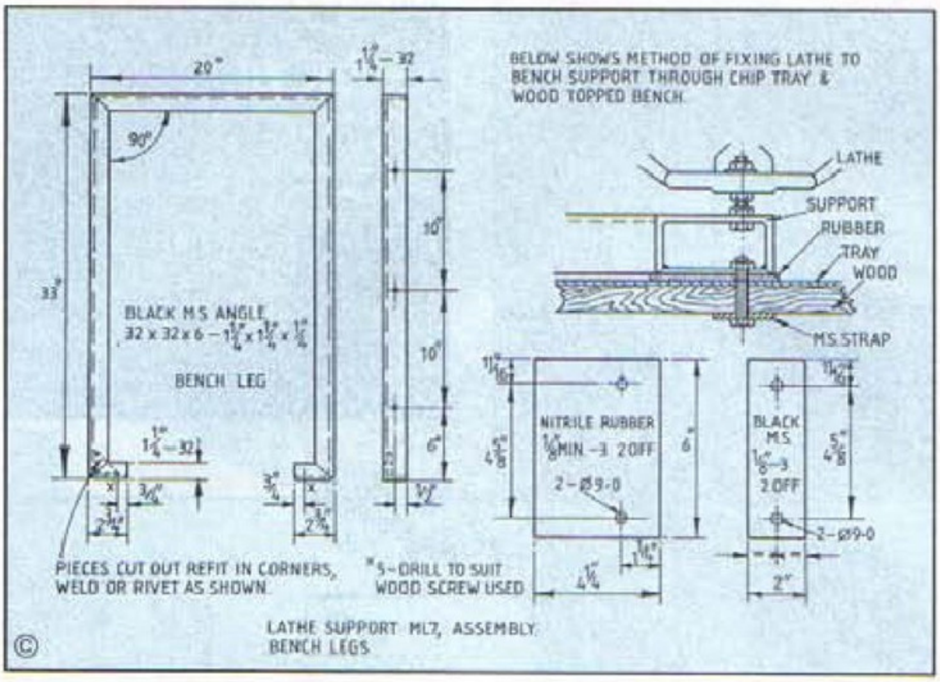
Make certain that the channel is dead straight then cut to drawing, now cut the two holding down straps from 2 × ⅛in. (50 × 3mm) black steel to fit just inside the two end parts, set up for welding on a flat plate or similar so that both strips are welded parallel to each other, dress if required, do be careful as liquid tightness depends upon the strips being flat and parallel, then mark off and drill the two 9mm dia. holes. Repeat for second end part.

Now put the centre part plus the two end parts together as shown on a dead flat plate and weld up, mark off the stud holes and drill 9mm diameter. You can use a sash clamp for this or at worst two house bricks to hold it. After welding I suggest it is stress relieved if possible or leave it in the garage for about 8 weeks for welding stresses to come out. Also at this stage you can, if you prefer, paint it to match your lathe. Now make the two rubber pads from either nitrile or neoprene of hardness 60/75 B.S. degrees, mark off and punch the two dia. 9mm holes as drawing. Mark off and drill, then debur the holes in the drip tray, then mark off an area the size of the rubber pads around the holes, degrease and apply Bostik 2 adhesive to it, also apply to one side of the rubber pads taking note of the maker's instructions before pressing into place.

Place the drip tray into the position you have chosen on the bench, the drain pipe against the edge **(photo 5)**, get the wife to hold it steady whilst you drill one hole, then drop in a screw to locate while you drill one the opposite side and repeat, then drill the last two. Remove tray and clean off the wood surfaces top and bottom, replace the chip tray, then lift the lathe support on the tray and place on to the rubber pads in place at each end, align fixing holes and fit the screws up through the bench as shown on the drawing and tighten enough to hold







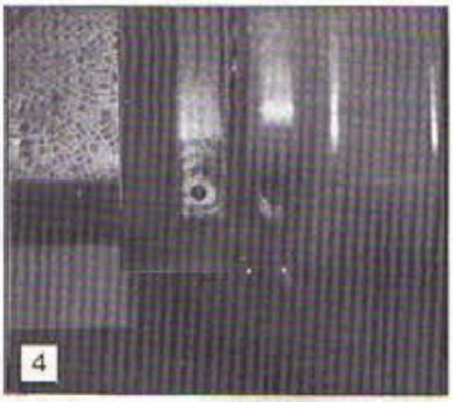
securely. Do not over tighten, if a direct reading torque spanner is available use it.

Not fit the four mounting studs as on the drawing, use Loctite 242 on the two nuts on the support, then fit one loose nut on each stud about 2.5mm up from top support nut, get a strong friend to help lift the lathe up and over the studs and carefully lower onto the nuts, it now only remains to fit the last four nuts and flat washers and the job is complete except for levelling the lathe by the method as described in *M.E.W.* in the Feb./March '92 issue.

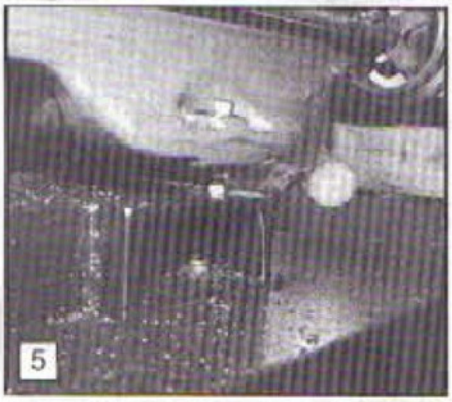
Providing you don't do anything dramatic with your machine this should solve your problems with a wooden bench.

The screen supports are used to provide a cheap chip screen around the tray, they drop over the tray sides and are bent to about 80 deg., the screen used is builders' grade polythene sheet, cut to 45×16in. for the rear, and 19x16in. for the tailstock end; fix into place by using Sellotape Sticky Fixers as can be seen in photos 1 and 3.

You can make a screen for your miller etc. by this method.



5: Position of the drip tray drain pipe.

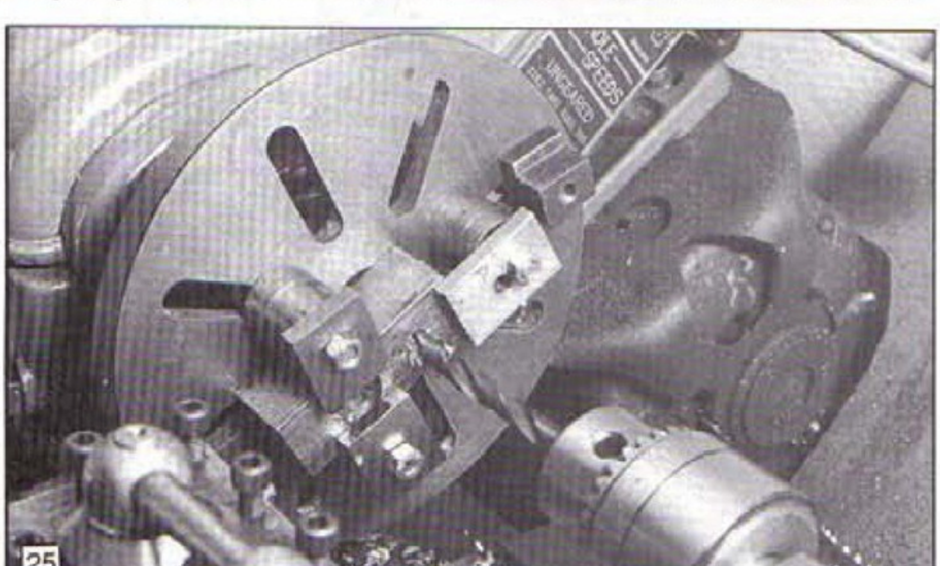


4: Close up view of the lathe mounting arrangement.

THE HART MULTI PURPOSE GRINDING REST

We conclude the article on the Hart multi-purpose grinding rest, commenced in the last issue, with some brief ideas for making the simpler parts, and some final comments on the device and its use.

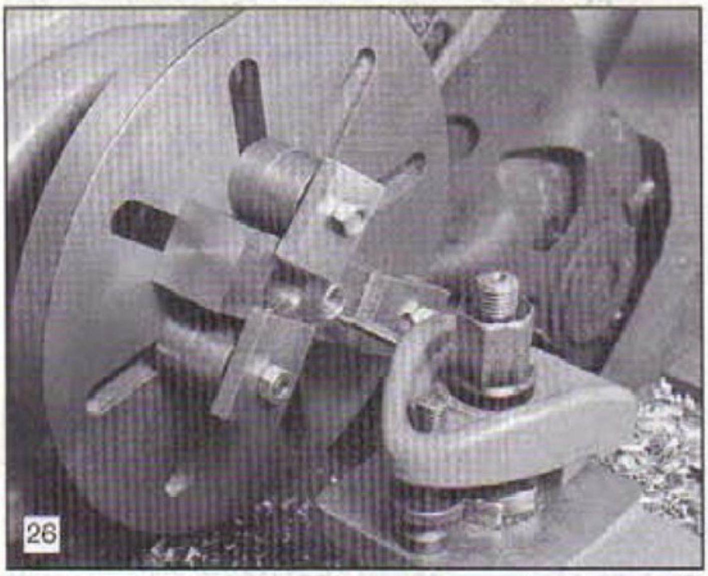
PART 2

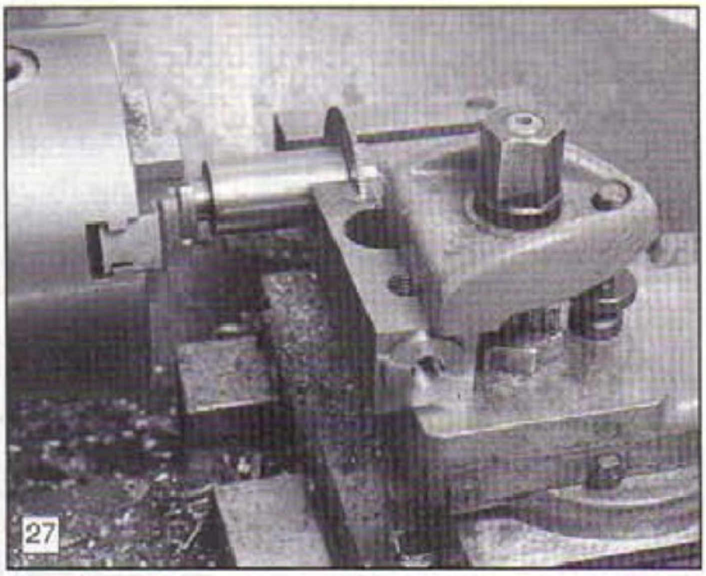


In keeping with making the larger threads metric the table adjuster was made M8 rather ⅜in. BSW as on the drawing. Having now used the rest, I consider that an even finer thread would be preferable even to the point of adding a calibrated dial. I will probably make this modification at some time in the future.

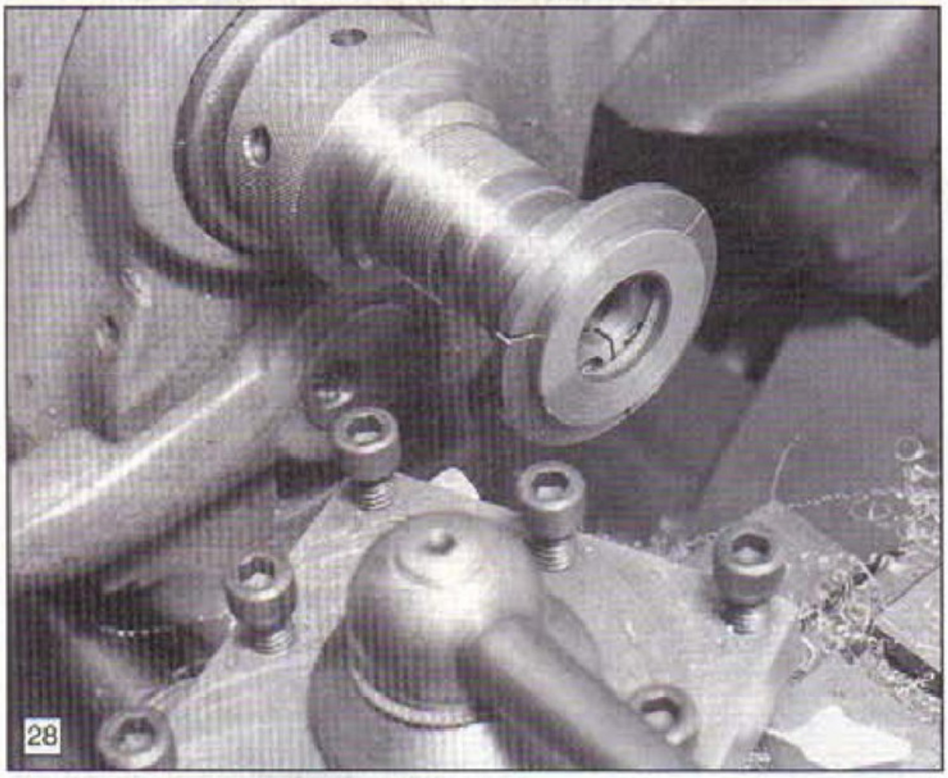
At first it would appear important that the two holes in the swivelling arm assembly and the associated small plate are at precisely the same centres, this is not the case. If the large hole in the small plate is made a generous clearance over the screw that fixes the ⅜in. diameter bar, then some adjustment is available. All the drawings were published with the first part of the article.

It is very important that the tapped hole for the adjusting screw is at right angles to the axis of the arm. To achieve this, drill a tapping size hole as shown in **photo 25** then bore out to exactly thread diameter,





25, 26, 27: *Machining the swivelling arm.*



28: Facing the large washer for the swivelling arm.

photo 26, and to about half the arm thickness, this will ensure the tap enters at right angles. Most of the remaining operations on the arm are straightforward. **Photograph 27** shows it being slit on the lathe using a slitting saw.

The large washer on the end of the swivelling arm is supplied in the form of a large washer stamped from ⅛in. black iron. Being ⅛in. thick it has a curved face and a black face with rough shiny edges. Whilst this is adequate for the application it does not look in keeping with a machine tool accessory. To improve this situation, turn a taper stub mandrel and mount the washer on this, turn the washer to give a clean edge and to a suitable diameter. Place in a thin piece chuck or, if not available, very carefully into a three jaw chuck, preferably with a large faced back stop, and face the washer also adding a small chamfer. **Photograph 28** shows the washer being faced whilst being held in a thin piece chuck.

The ⅜in. dia. bar is fitted into the table using a suitable adhesive. To avoid any possibility of the trapped air attempting to force the bar out whilst the adhesive is setting, drill a small hole completely through when making the thread in the end.

The fence is supplied with a non-bright finish being a piece of 1x1x⅛in. angle iron. This could have its faces machined, or alternatively cleaned up with a file. A better approach would be to substitute the material supplied with a piece of 25x25x3mm bright angle, as is the case with the one illustrated.

The small sliding portion which slides backwards and forward in the table slot is supplied oversize and requires machining both for thickness and width. The width is the least critical as it has a small spring and plunger to take up any play that is present, even so, it is preferable to achieve as close a fit as is possible whilst still being able to slide freely. The thickness is important as no adjustment is provided, this must be made about 1 thou. thicker than the machine table just allowing the various items fitted to slide freely without too much play being present. The piece of metal was supplied well over size and required quite a lot to be machined away, this can be seen being done in **photo 29.**

A piece of 1in. square mild steel is provided for a holder, details are not included in the drawings published with this article, to enable the sharpening of end mills and slot drills. This has to be bored to suit the largest end mill for which it is to be used; also provided is a length of round mild steel for making adaptors for smaller diameters. I feel a better approach would be to make individual holders from 1in. square mild steel for each size required, and this is what I intend to do. When setting up the square material in the four jaw chuck for boring, ensure it is accurately

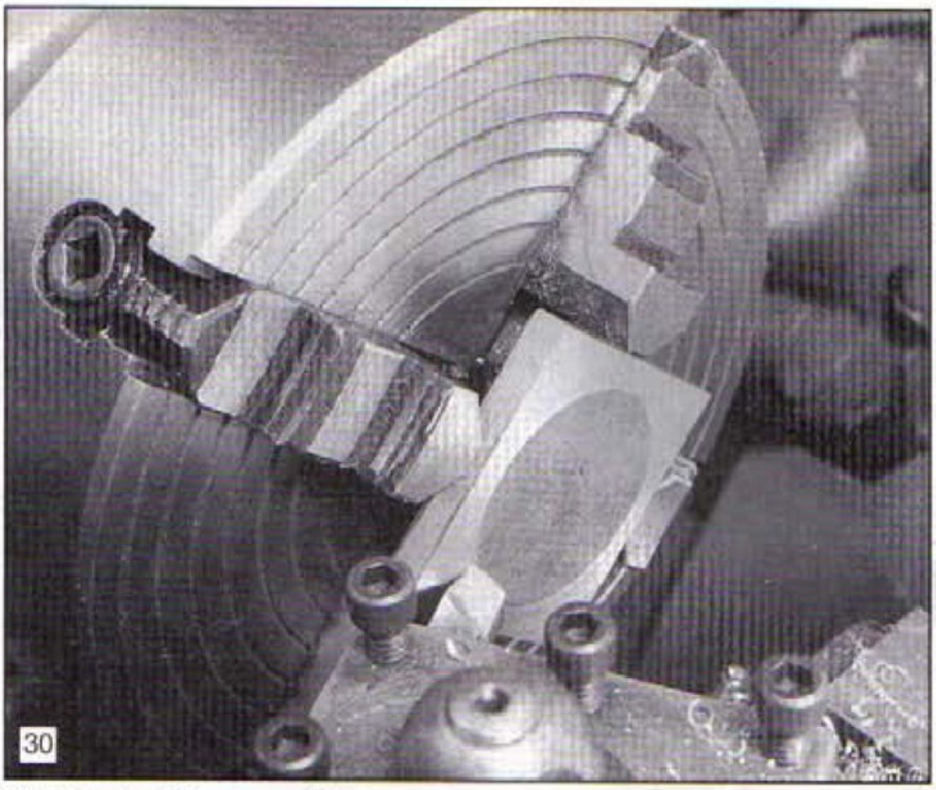
29: Sizing the part that slides in the table slot.

set, as it is very important that the bored hole is concentric with the four sides.

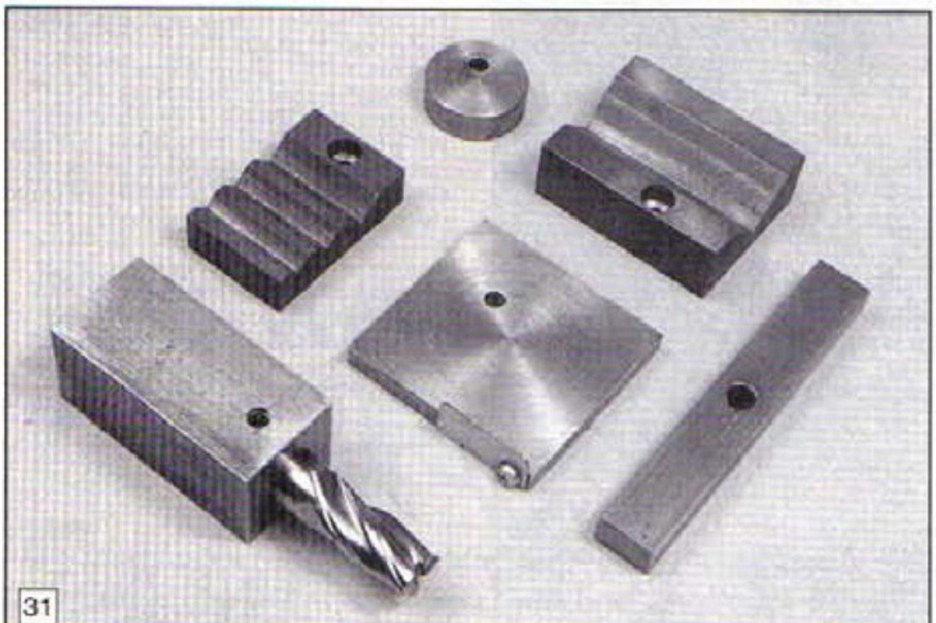
The piece of ¼in. plate provided for the slitting saw carrier was rather pitted and showing signs of slight rust, a slight rub over a piece of emery paper would suffice but machining both sides was carried out for appearance sake. This can be seen being done on **photo 30.** When machining the second side parallels are placed behind the plate prior to fully tightening the chuck. It is essential that the parallels are then removed before the lathe is started up. **Photograph 31** shows this part after completion, together with most of the other loose accessories.

Final thoughts about the kit

Having completed the grinding rest it must be said that the castings were all of good quality and machining was easy, once the items were in place. They do, owing to their size and shape, present quite a challenge when using only the milling facilities of a lathe. However, it is far from impossible and a satisfactory result was achieved. Owners of a milling machine will find the manufacture much easier, though holding the casting will still present some interesting problems.



30: Facing the slitting saw carrier.



31: Most of the loose accessories used with the grinding rest.

The mild steel provided was free cutting which made the machining easy, in fact the 1in. square material was particularly free cutting, probably leaded. This tempted me to consider disposing of all my round and rectangular bar and replacing it with leaded types, where available; still that is another story.

The kit included all the hardware items, including spring, screws, washers, nuts and studding, with just one minor exception, there appeared to be no screw for the indexing wrench (drawing not published with this article.).

Putting the rest to use

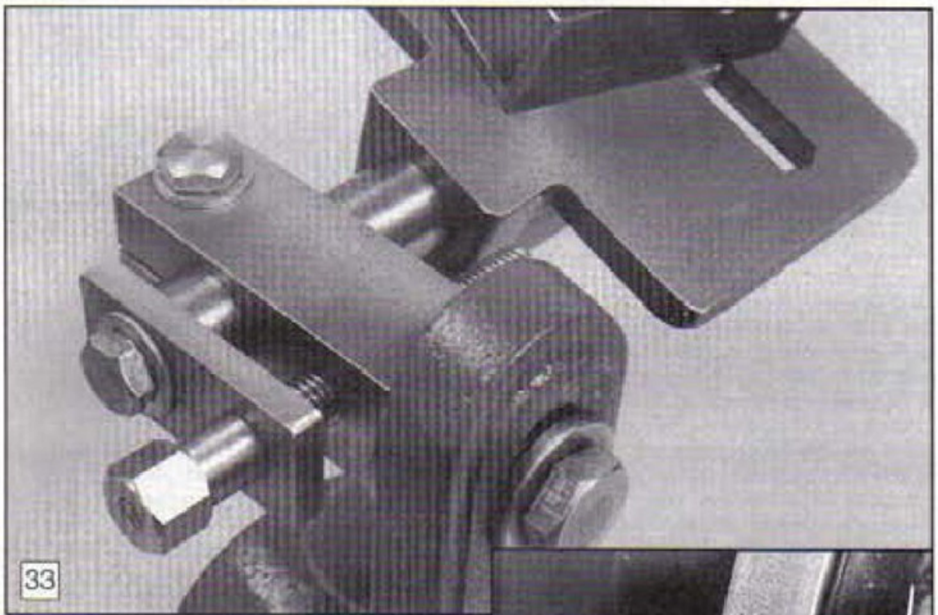
The first thing to do when putting the rest to use will be to mount it in front of the bench grinder. This is likely to be easier said than done, as almost always the grinder is mounted at the front edge of the bench or shelf for ease of use. In this probable situation, it will either be required to mount to grinder further back, or to add an extension in front. If either of these options are taken as a permanent measure, it may be found an inconvenient approach when being used without the rest. There would appear to be two alternatives.

One possibility would be to mount the grinder onto a base, fitted between grinder and bench top. A quick release could be incorporated which would permit the grinder to rapidly take either the front or rear position. If space is available behind the grinder, then this is probably the best approach, as it makes available a rigid area on which to mount the grinding rest.

However if the grinder is fitted on a narrow shelf, as is often the case, then an extension will be necessary. An absolute necessity of this extension is that it is very firm, as any flexibility will reduce the accuracy of any grinding done. **Photograph 32** shows the method adopted in the case of the one made in the article.

Whilst the slotted arm will give all the adjustment required towards and away from the grinder, some left to right adjustment should be incorporated. The rest may required some packing to bring it up to the required height, in which case it can, if time is in short supply as was the case for the one seen in the photograph, be mounted onto a piece of wood the required thickness. This can then be fixed in position using a G clamp or similar which would permit it to be moved left and right. Perhaps at a later date, a more engineered approach to this may be created which can then be the subject of an additional mini article.

32: Mounting the grinding rest. The extension is firmly screwed to the front edge of the bench on which the grinder is mounted. Note the essential support below the extension to give the rigidity required.



33: *Close-up showing the adjustments available.*

Having now mounted the rest it is time to give it a workout. It is not intended to go into detail regarding this as very adequate instructions for its use are provided with the kit. **Photographs 34 to 37** show it being put to use. Just a few comments are worth making. **Photograph 33** shows the adjustments available in close-up, these are: The in/out adjustment by means of the lead screw. The table can be angled in one plane by loosening the screw into the end of the ¾in. dia. bar and in the other plane by the screw in the end of the 1in. square bar. The angle of the fence can be adjusted by loosening the screw that fixes it to the piece that slides along the slot in the table.

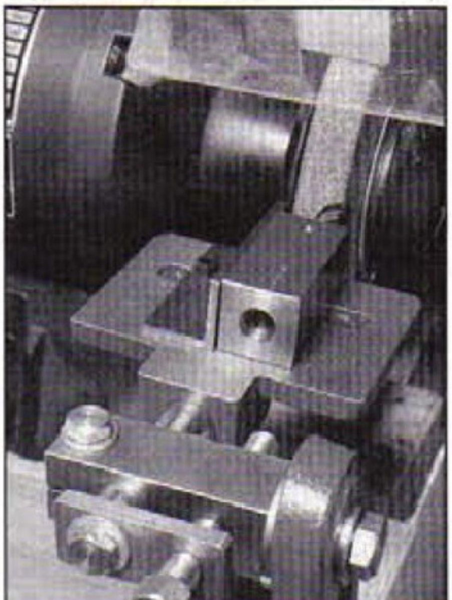
When sharpening end mills the screw in the end of the fence, just visible in **photo 36,** ensures all four cutting edges are ground to the same level. **Photograph 37** shows a slitting saw being sharpened, the leaf spring is used to locate the saw when indexing, whilst the plate held with a clamp acts as a stop to ensure only one tooth is ground as it is moved left and right.

34: Sharpening a lathe tool.

As a final comment, the rest produced far better results than would be possible with purely hand grinding, and for the operations that it could carry out, almost the equal of a fully fledged tool and cutter grinder. However, in the case of the tool and cutter grinder, operations would be possible, such as grinding along the sides of an end mill, which would not be achievable using the grinding rest. Even so, I am sure that with a few additional attachments this, and other operations, would be possible.

QUICK TIP

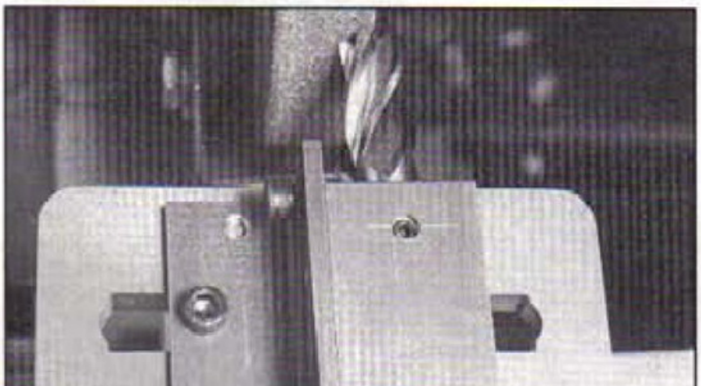
A broad felt tipped pen used instead of marking out (layout) fluid is quick, easy and economical, particularly on small components. **Hugh Mothersole**



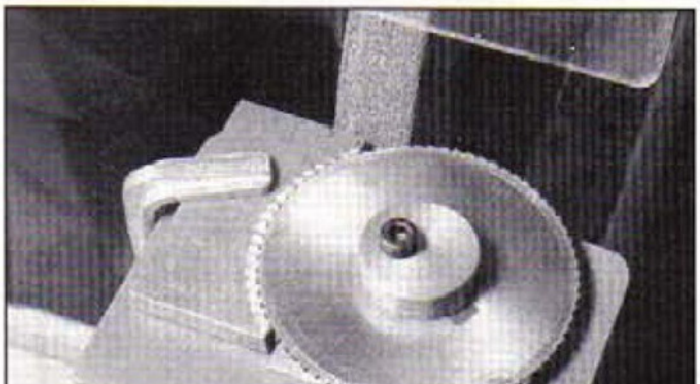
35: Sharpening an end mill.

Supplier details

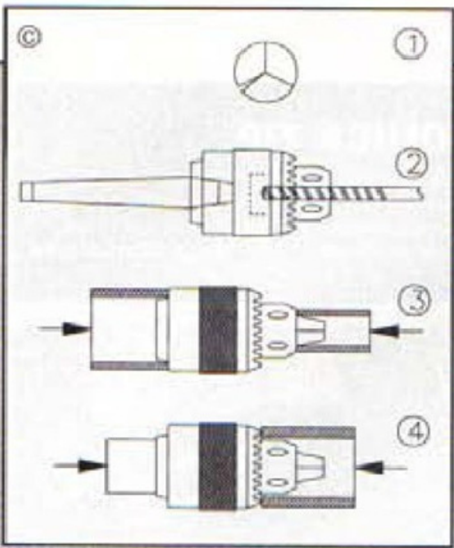
Hart Engineering, Greenfield House, 19 Greenfield, Rhosddu, Wrexham, Clwyd, LL11 2NR. Tel. 0978 359207.



36: Note the screw added to the end of the upright face of the fence. This acts as a stop to ensure each cutting edge is at the same level.



37: A very badly worn slitting saw being made usable again.



Dismantling a Jacobs Type Chuck

How a Jacobs type chuck is assembled is far from obvious, hence dismantling for cleaning and maintenance is frequently a non-starter. In this brief article, provided by Doug Cooper, he lets us in to the secret as to how this is done.

Frequently Jacobs drill chucks can be found on secondhand stalls. Provided the jaws close equally, stiff operation or damaged arbors are not an insurmountable problem.

To remove the taper arbor from the chuck body, rotate the open chuck in the lathe and drill through the rear of the body, say 0.25 inch. Pass a punch through the hole, to the head of the arbor and drive it out. New arbors can be obtained from the usual tool merchants, but take the body, chuck tapers do vary in size.

To disassemble the chuck for cleaning, make up a short tube to clear the rear of the chuck body and a similar one just large enough to clear the jaws. With the jaws nearly closed apply opposite pressure to the two tubes. This will force the gear ring off the body. (Some makes of chuck may come apart in the opposite direction.) It may take quite a hefty pressure to shift it! When the gear ring parts company with the body you will find a split ring inside – yes, it is made that way! Remove the split ring and the three jaws can be slid out. Either clean them individually or mark them so that they go back in the same position. Some are numbered but others may not be, so take care.

Clean and check the jaws for burrs on the gripping surfaces – these can be carefully stoned off. Check also for burrs on the nose of the chuck, where it may have contacted the work at some time.

To reassemble, lightly oil and slide the jaws into the body. Replace the split ring, with the jaws in the near closed position, and push the gear ring onto the body. Using the larger tube, press the gear ring back onto the chuck body. Make sure this goes fully home or the key will not fit the gear ring.

Sometimes for milling operations, it is necessary to retain a Morse taper arbor in the machine mandrel with a drawbolt. Although Jacobs chuck arbors look rather hard they can be drilled and tapped for a drawbolt. First cut off the tang, a "blue blade" will do this easily and set the arbor up in the lathe to run truly. On my Myford I push the "chuck" end of the arbor into the Myford mandrel and grip the middle of the arbor in the three jaw; not ideal, but it seems to hold it well enough to drill the tapping hole: ⅜in. BSW was used for No.2 Morse tapers, but this may have changed since metrication. *(If being used for milling the chuck must be made captive to the arbor. Perhaps a screw into the arbor through the hole in chuck as made in 2 above. Ed.)*

A DIVIDING HEAD FOR THE PEATOL LATHE

PART 2

This small dividing head which is intended for use on the Peatol Micro Lathe, has been designed and made by Tony Jeffree. The Peatol lathe has not been featured greatly in *M.E.W.* and the article will, I am sure, be of great interest to owners of this lathe. The design in no way limits its use to this lathe; it would be equally at home on any other small, and not so small, lathe. An interesting feature is that Tony's drawings were done using AutoSketch CAD software, see his letter page 8 of issue 17. Tony's drawings are published as received, we have made no changes to them.

The indexing arm and detent assembly

The indexing arm and detent are made from the components shown in **Fig.17 - 21. Fig. 22** shows the assembled arm and plunger.

The indexing arm itself is a 2 x 3/8 x 3/32in. strip of brass, see **Fig. 17**. Radius the two ends, cut a 1/8in. wide axial slot, starting 1/4in. from one end and extending for 1½in., drill a 3/16in. hole 3/16in. from the other end.

The detent is a spring-loaded plunger that can be locked in the raised position by pulling the plunger out and rotating half a turn; the action, as illustrated in **Fig. 22,** will no doubt be familiar. The plunger is a 1.5in. length of 3/32in. silver steel rod, with one end turned to a taper, see **Fig. 18.** The angle of taper is not important as long as it will seat nicely in a 3/64in. hole; tapering the last 1/16in. of the plunger to leave 1/32in. dia. at the tip is about right. The point should be nicely rounded off to avoid scoring the division plates when in use. A spring retainer is fitted onto the tapered end; this is simply a short length of 3/16in. brass rod drilled 3/32in. and superglued in position. The other end is threaded 7BA to screw into the detent knob. The final length of the plunger should be checked and adjusted after assembly of the complete head, as it is preferable that its tip clears the surface of the division plate and sector arms when the plunger is in the raised position. Some adjustment of clearance can be obtained by loosening the worm's grubscrew and adjusting the overhang on the worm shaft.

The detent knob and pillar, **Figs.19 and 20** respectively, are a simple turning and filing operation; they can be turned "back to back" from a single piece of 3/8in. brass rod, with the pillar end held in the chuck; drill an axial 7BA tapping size hole (2.1mm), part off the knob, drill the pillar 2.4mm (this is sufficiently oversize to allow the 3/32in. plunger free travel), enlarge the axial hole at the narrow end of the knob for a length of 3/16in. and tap the hole 7BA. File flats just in excess of half-way through the narrow portion of knob and pillar, to "halve" the axial holes. Fit the pillar to the hole in the end of the indexing arm, fix in place with superglue. File the base of the pillar flush with the underside of the indexing arm. Fit the plunger, spring and knob, Loctiting the threaded end of the plunger if you feel so moved. The spring used in the prototype was part of the return spring salvaged from a cheap retractable ballpoint pen.

A simple cup washer, with a 4BA csk screw, is used to attach the arm to the worm shaft. The washer, shown in **Fig. 21,** is cut from 3/8in. brass rod; mount a short length in the 3-jaw chuck, drill a 4BA clearance hole, countersink sufficiently to allow the screw to sit flush, then part off the washer. The finished thickness will need to be somewhere around 1/16in. to 3/32in. depending on the depth of countersinking, but this is not at all critical.

The division plates and plate carrier

Once the indexing arm is fitted onto the worm shaft, the dividing head is operational, if only on the basis of the division possibilities provided by the 30:1 drive ratio. The next series of machining operations makes use of the partially completed dividing head in order to manufacture the division plates and their carrier.

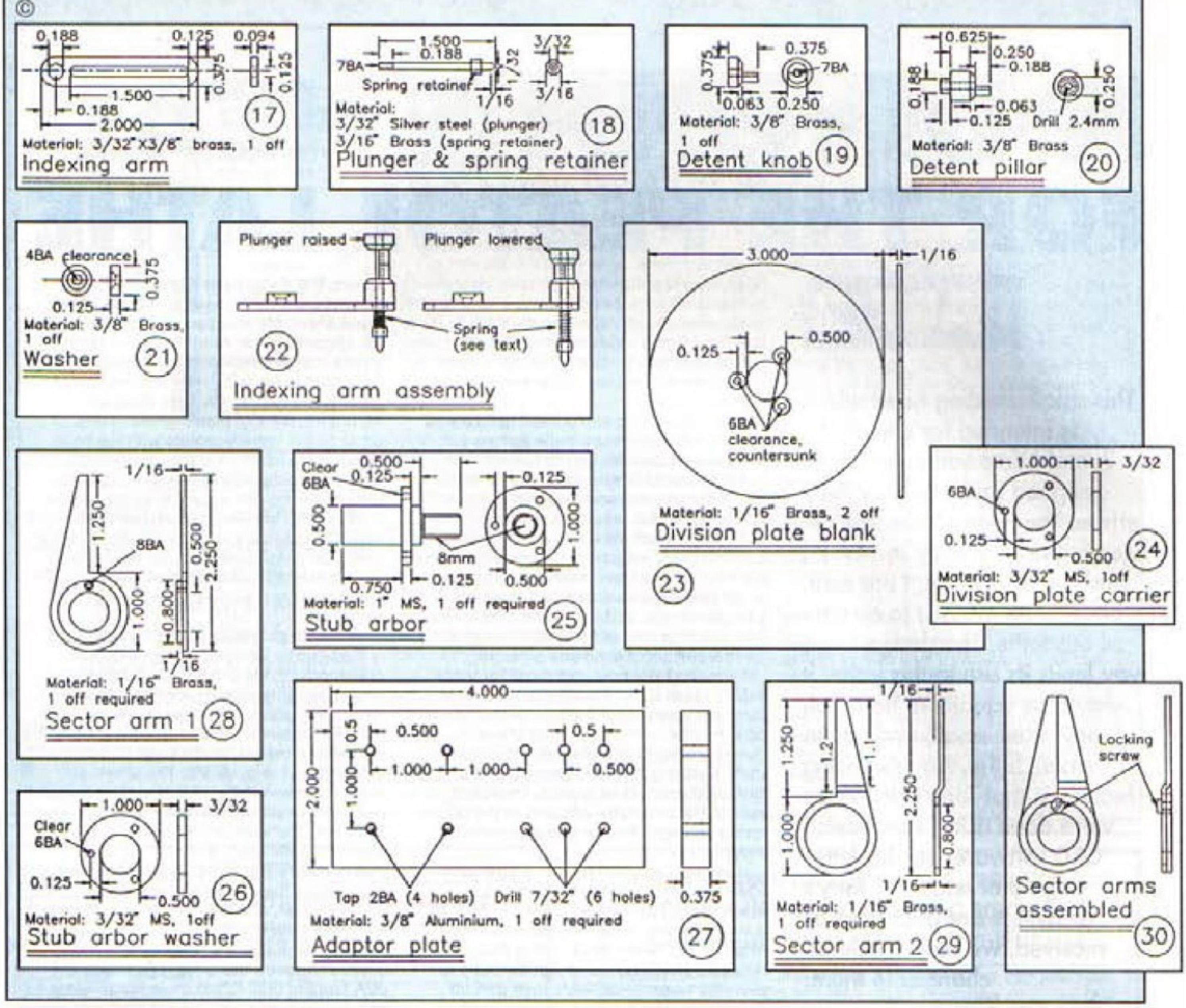
Fig. 23 shows a division plate blank, and **Fig. 24** the division plate carrier. The carrier is a simple steel washer, 1in. dia., 3/32in. thick, with a central 1/2in. hole and three equally spaced holes drilled and tapped 6BA. The division plate blank is a 1/16in. thick brass disc, 3in. dia., with a central 1/2in. hole and three csk 6BA clearance holes to match those in the carrier. The countersinking should allow the heads of the screws to be sunk flush with the surface of the plate. The number of division plates required will vary according to the applications you have in mind, but the minimum required for the machining operations described here is two blanks, one of which will be used to make the protractor referred to earlier.

The blanks are ideally obtained ready cut to size, but if you have to do it the hard way, you start with a suitable piece of 1/16in. brass sheet. My approach was to mark out the circumference, roughly cut the blanks to size, clamp them together, drill two mounting holes fairly near the centre (but outside the central 1/2in. hole area) and mount the stack of plates (three in this case) on the lathe faceplate with tee bolts through the holes. It is then a relatively trivial job to drill the central 1/2in. hole and trim off the ragged edges till all the blanks are circular. My blanks ended up a little oversize, but this is not a problem; in fact, it would be possible to increase the division plate dia. to 3½in., with corresponding adjustment of the indexing arm length, if so desired.

A simple stub arbor, detailed in **Fig. 25,** is made up to facilitate the remaining operations on the division plate blanks. The dimensions shown assume that you have a 1/2in. capacity Jacobs chuck available that will fit the dividing head output shaft; if not, reduce the dia. of the shaft to suit the chuck you have available. The arbor, its washer (shown in **Fig. 26**) and the division plate carrier are turned down from 1in. dia. BMS rod. The washer and carrier are stacked on the arbor and held firmly in place with the 8mm nut; the arbor is then mounted in the Jacobs chuck on the dividing head, and the latter is mounted on the cross slide with the output shaft in line with the lathe spindle. Mount a smaller Jacobs chuck on the lathe spindle and fit a 6BA tapping drill. Offset the cross slide by 3/8in. in preparation for drilling the three holes, lock it in position. Release the dividing head brake, rotate the indexing arm clockwise until it is vertical; this can be checked by lining up by eye against a handy vertical such as the edge of the main frame of the dividing head. Lock the brake and drill the first hole through the two washers and the flange of the arbor. Unlock, make 10 full clockwise turns of the indexing arm, lock, drill the second hole, unlock, 10 turns, lock, drill the 3rd hole. The division plate carrier is now removed and the three holes tapped 6BA. Re-assemble the arbor, this time with one of the division plate blanks sandwiched beneath the washer, carefully realigning the holes in the washer with the end of the drill. Fit a 2.9mm (6BA clearance) drill and repeat the drilling operation. Repeat for all the blanks.

Unscrew and remove the indexing arm from the worm shaft. The division plate carrier should be a tight fit over the turned section of the worm carrier; press it fully home, using a little superglue to hold it permanently in place. Re-fit the indexing arm.

The first circle of holes can now be drilled in one of the indexing plate blanks. As discussed earlier, the first requirement is a 12 hole circle, to facilitate marking out the protractor. The drilling set-up is unchanged from the last drilling operation, except that the cross slide is further offset so that the circle of holes will appear at a



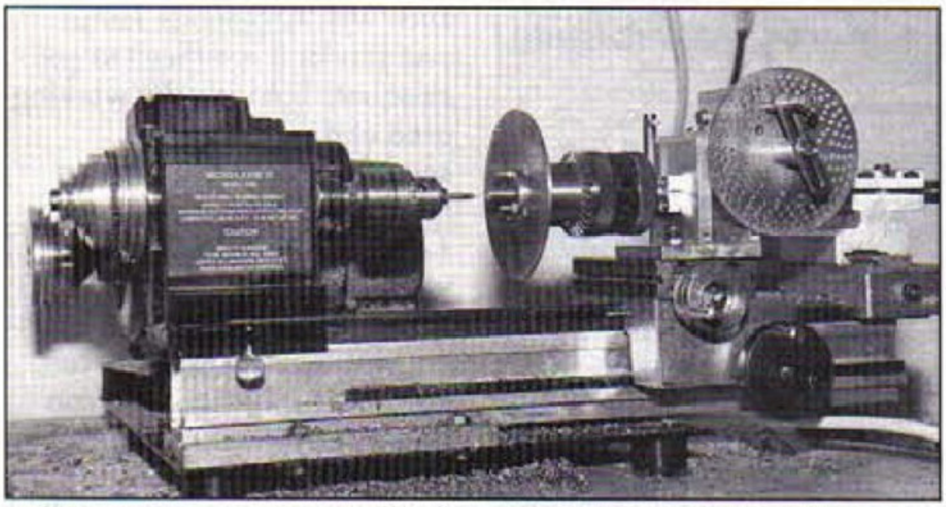
suitable position on the blank. As 12 is a relatively small number of holes, place this circle as near to the centre as possible, but avoiding any mounting holes drilled when machining the blanks. 6BA screws and nuts can be fitted through the stub arbor, blank and washer to make absolutely certain that the blank will not rotate relative to the arbor. Fit a No.1 centre drill in place of the 2.9mm drill in the lathe, carefully drill the first hole, adjusting the stop on the saddle travel so that the result is a lightly countersunk hole in the division plate blank. Unlock, rotate the indexing shaft by exactly 2½ turns, lock, drill...etc. until all 12 holes are drilled. Stamp 12 between two adjacent holes, using small number punches, so that you can easily identify the number of holes in the circle at a later date without having to count them (a tedious business with large numbers of circles/holes). As mentioned earlier, the half turns are easy to judge by eye against a suitable vertical (the same one you used for judging the full turns). For the purists, it is a simple matter to drill a 2-hole circle in one blank, fit that blank to the division plate carrier with 6BA csk screws, then cut the 12-hole circle in the second blank, but I decided life really was too short for that.

Now for the protractor. Fit the 12-hole plate to the division plate carrier and a fresh division plate blank on the stub arbor. Release the brake, adjust the indexing arm until the plunger is on the same radius as the 12-hole circle. Rotate clockwise till the plunger seats in one of the holes, then lock the brake. Fit a sharp scriber in place of the centre drill in the lathe; this can simply be a short length of silver steel rod turned down to a sharp point. Adjust the offset of the cross slide so that the scriber will strike the blank 0.1in. from the circumference. Use the saddle handwheel to press the blank against the scriber, traverse the cross slide until the scriber clears the edge of the blank. If you've done it right, this should result in a 0.1in. long radial line scribed in the surface of the blank. Move the saddle to the right away from the scriber and traverse the cross slide back to the starting point for the next line. Release the brake, rotate the indexing arm clockwise by one hole, lock and repeat the scribing operation. This process is repeated round the entire circumference of the blank, 360 lines in all, but for every 5th hole, extend the scribed line length to 0.2in. and every 10th line, extend the scribed line length to 0.3inch. This is a very tedious process, but the reward is a nicely marked out 360 degree protractor. To simplify reading the angles, it helps to stamp the number of degrees, perhaps at every 30 deg. mark round the circumference, using the smallest set of number stamps you can obtain. With careful positioning of the numbers, there should be some space left towards the centre of the plate to fit in a few circles of holes. The marks on the protractor will not be terribly visible at this stage, but this can be fixed by coating the marked areas of the blank with a spirit-based black felt-tip pen and then polishing off the excess, leaving ink only in the grooves.

Using the protractor to cut hole circles in the division plates

The protractor and division plate can now be swopped back to allow further circles of holes to be drilled in the division plate.

The choice of additional circles of holes in the division plates will depend greatly on the applications you have in mind. If you wish to divide a circle by a given number (N), the product of the drive ratio (R) and the number of holes in the chosen division plate circle (H) must be exactly divisible by that number. In other words, N must be a factor of R x H. So, with no additional circles of holes, the 12-hole circle combined with the 30:1 drive ratio will give all the division possibilities that are factors of 360, in other words, 1,2, 3,4, 5,6, 8,9, 10, 12, 15, 18, 20, 24, 30, 36, 40, 45, 60, 72, 90, 120, 180 and 360. In each case, dividing 360 (R x H) by N gives the number of holes in the circle by which the indexing arm has to be moved for each division, so to get 90



Dividing head set up on the cross-slide of the lathe to drill a hole circle in a division plate blank. The Jacobs chuck in the headstock holds a No. 1 centre drill.

divisions, the arm is stepped by 4 holes between each division.

The protractor is, in effect, a 360-hole circle, so if the indexing arm is moved in whole degrees, the protractor gives the division possibilities of all the factors of 10,800 (I leave it to you to work out the complete list!). So, if you wish to cut a circle of N holes using the protractor, 10,800 divided by N gives the number of deg. of rotation required between each division. In practice, it is possible to get acceptable accuracy for most purposes using the protractor, even in cases where a fractional number of deg. of rotation is required. For example, if you wanted a 7-hole circle, it would be necessary to rotate the indexing arm by 1542.86 deg. (four full rotations plus 102.86 deg.) for each division. If you were to round this up to 1543 deg., the error in the positioning of the arm would be 0.14 deg. for the first division, 0.28 for the second, and 0.84 deg. for the last. Given that this gives an error in the positioning of the output shaft of only one thirtieth of those amounts, this should not be a cause for concern, as I pointed out earlier. It is advisable when using the protractor in this way to construct a table showing the final position of the indexing arm and the number of whole turns (if any) for each division. If the calculation of all the positions is done to several decimal places and then rounded to whole deg., the maximum rounding error for any one division will be less than half a degree, so rounding errors will contribute an error of up to 1/60 degree at the output shaft.

For many purposes, then, the 12-hole circle and the protractor will provide sufficient division capability between them without bothering to cut further circles of holes. However, it is often convenient to have a larger range of division possibilities available, if only to avoid having to calculate the unusual divisions in (fractional) degrees. As an exercise, I spent an evening working out the minimum number of hole-circles that I would need in order to provide all the division possibilities from 1 to 50, plus all the even numbers up to 100, plus 360. The result was a list of 16 hole-circles; 10, 26, 28,29, 31, 32, 34, 36,37, 38, 41, 43, 44, 46, 47 and 49 holes. This set also gives many division possibilities in addition to those mentioned, for example all the multiples of 5 up to 100. Adding circles of 21, 27, 33, 77 and 91 holes fills in all the multiples of 3 and 7 up to 100, and so on. However, in order to avoid spending inordinate amounts of time in the laborious process of cutting division plates, it is worth starting with a minimal set covering the divisions you are most likely to need, and cut extra circles later on as the need arises. I found that 1/8in. between adjacent circles was about right, allowing at least 6 circles of holes per blank; it is just about possible (but tight!) to construct a 120-hole circle on the outer edge of the 3in. blank, which would give rotations of 1/10 deg. per hole at the output shaft.

The adaptor plate

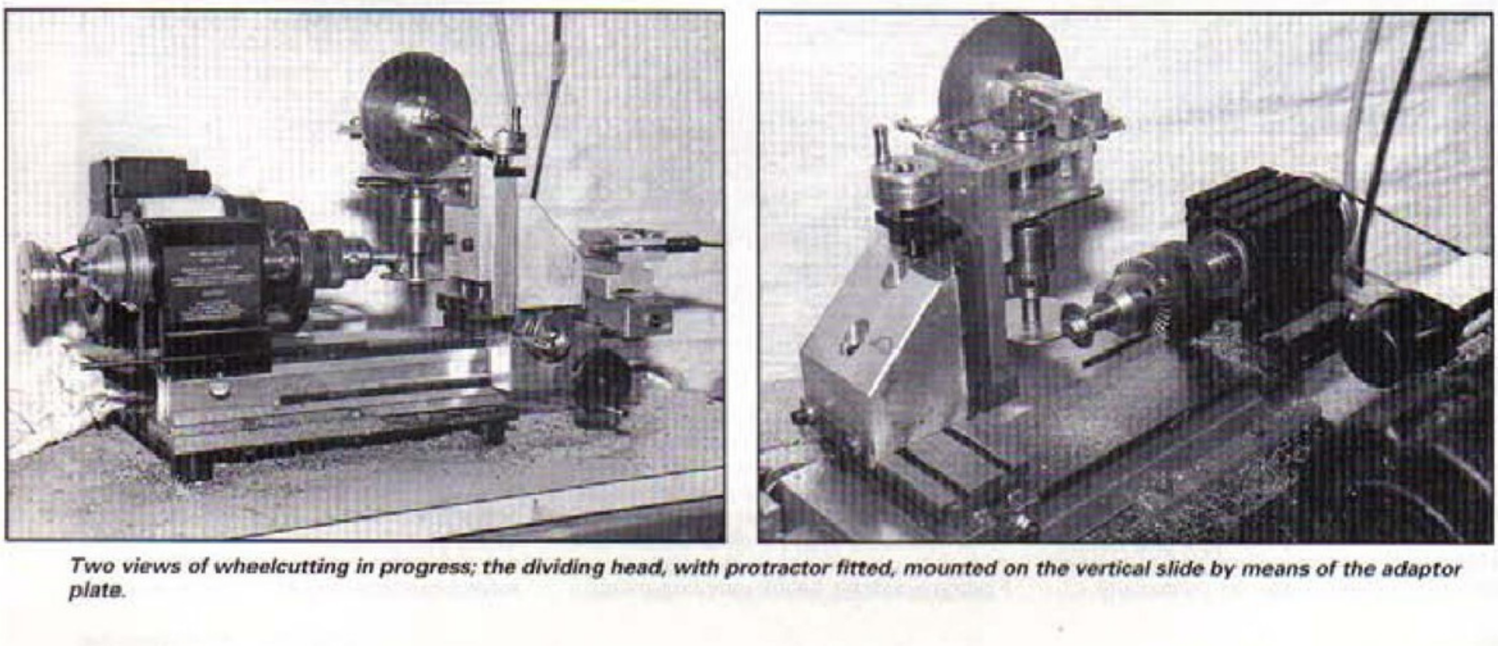
Fig. 27 shows an adaptor plate that provides greater height when the head is fitted to the vertical slide, useful when using the head for wheelcutting, radial drilling, or other machining operations. The construction is straightforward and self explanatory. The four tapped holes allow the dividing head to be bolted to the adaptor plate with 2BA bolts; the six remaining holes allow 2BA T-bolts to attach the plate to the vertical slide at an appropriate height and orientation. The adaptor plate can be seen in use in the photograph which illustrates the wheel cutting operation in progress.

The sector arms

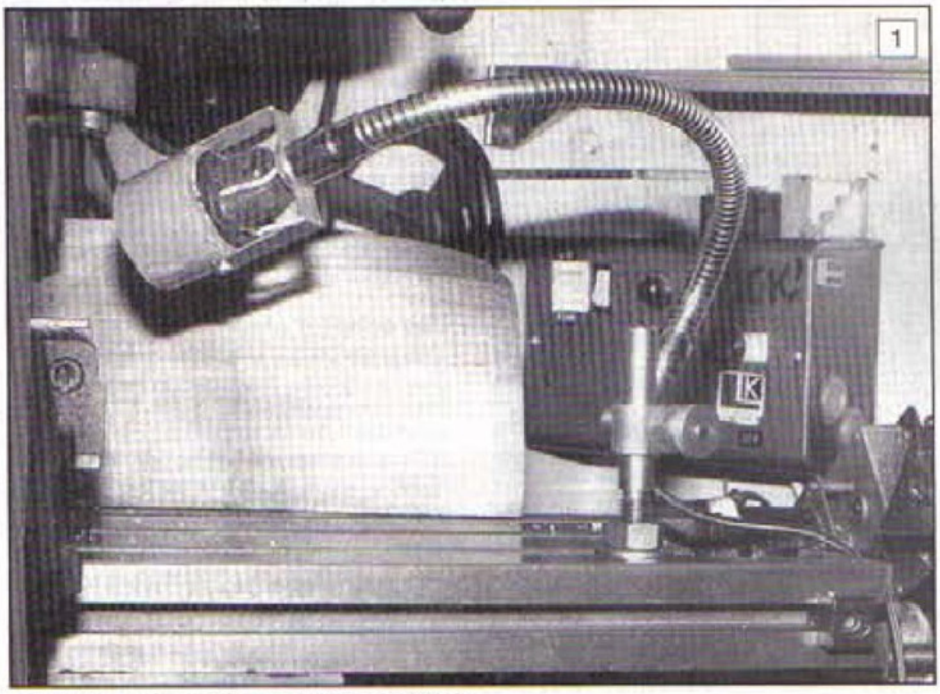
Last but by no means least, the sector arms. These are fabricated from 1/16in. thick brass sheet, as shown in **Figs. 28 to 30.**

The two sector arm blanks are cut to shape using a piercing saw, fretsaw or similar, and are clamped together to finish the outer edges to shape. Sector arm 1 is drilled or bored to 1/2in. dia., sector arm 2 to 0.8in. diameter. A separate washer, 0.8in. dia. and with a 1/2in. hole, is made from 1/16in. brass sheet and soft soldered to sector arm 1. (Alternatively, a 0.8in. dia. blank could be soldered in place on sector arm 1 prior to drilling the 1/2in. hole, if preferred). Sector arm 2 should be a sliding fit over the 0.8in. dia. washer, and is kinked as shown so that both fingers lie flush. An 8BA tapping hole is drilled as close as you dare to the edge of the washer, and tapped. The intention is that an 8BA screw will just lock both arms together when it is screwed home; it may be necessary to slightly reduce the thickness of the washer around the 8BA hole in order to achieve the desired effect.

Continued on page 66



Two views of wheelcutting in progress; the dividing head, with protractor fitted, mounted on the vertical slide by means of the adaptor plate.



1: The lamp mounted on the milling machine.

Even with Anglepoise lamps and similar it is difficult to get adequate light into the working area of a machine, and something smaller and more flexible is preferable. J.M. Service has made a low volt system using a gooseneck to achieve the flexibility, this enables the light to be placed just where it is needed, it can also be easily moved from machine to machine using a quick release arrangement. Its low working voltage is an added advantage, being a very good safety feature.

LOW VOLTAGE LIGHTING

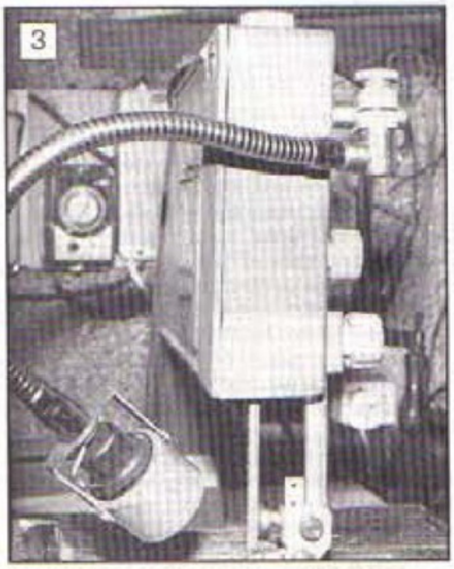
2: Close up of above; this was taken without a flash and shows how effective is the illumination.

It is a sad fact of life that many of us in this great hobby are past the first flush of youth and our eyesight is perhaps not quite as sharp as it used to be. My own tiny workshop is lit up like a gin palace, but there are still areas which are difficult to illuminate and perhaps the vertical milling machine is worst of all. Desk lamps, spot lights, Anglepoise lamps etc. were tried. All were only moderately successful – most of them got in the way and all were potential hazards; I was even reduced to a torchlight on one occasion; it was surprisingly effective, but not having a third hand was a definite handicap. After one particularly tiresome session of peering and squinting and Braille type measuring accompanied by a shameful excess of workshop Esperanto I decided it was high time to make a light fitting which would fill my requirements.

The lamp was designed primarily for the milling machine; it was originally intended for fixing on a magnetic stand and this feature has been retained. The short standard fitted into one of the table slots was found to be an improvement; being considerably more rigid and taking up less space than the magnetic stand. Applications on other machinery as shown in the photographs were a natural follow-on to the original scheme ... I really must make one or two more!

The basis for the lamp is a 'gooseneck'. Bull Electrical (usual disclaimer) stock 8, 12 and 21in. lengths; mine is the middle one and cost around £3 plus postage. It comes with a male connector at one end and a female one at the other; both these are screwed what appears to be ⅝in. x 26 TPI Standard Brass thread; the tapping or bore size on the drawing is the one I used; the book says it should be 0.578in. and the outer diameter 0.625in. – take your pick. If you do not feel up to cutting an internal thread in the thimble, it can be bored to a good fit over the thread and secured with a grub screw or Loctite or both.

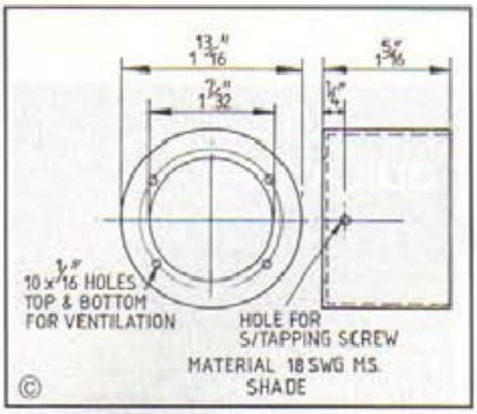
Once upon a time you could buy beautiful little brass lampholders suitable for automotive bulbs and having a female fixing screw; if you are lucky enough to find one of these, it would be an easy matter to fit it with a reducing ferrule straight on to the gooseneck and use a simple shade, say a small tin can secured by the shade ring. Finding a suitable holder may be a minor

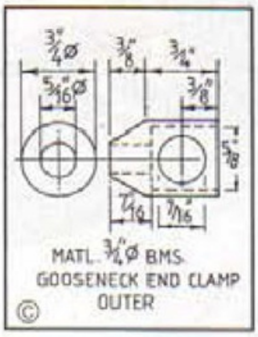


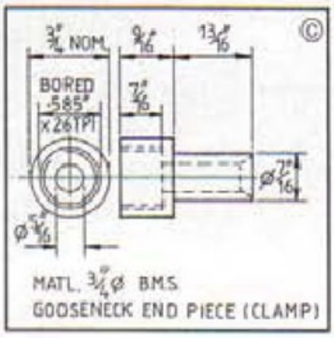
3: The fitting in use on a bandsaw.

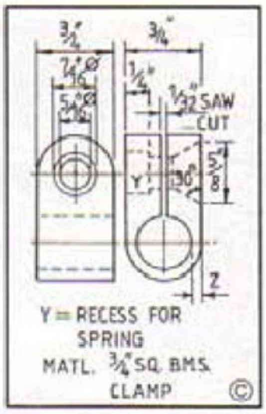
problem; don't waste time going to the big automotive dealers, rather go to a small one-man garage or car boot sale, they are usually sympathetic to fellow eccentrics. The one I found is the type which clips into the rear of the light fitting; it is single bayonet cap and the bulb is 12 volt 21 watts. The shade is made from 18 or 20 SWG mild steel with the seam and endplate silver soldered or brazed, it needs some ventilation holes as shown. It is fastened to its bracket by two self tapping screws; the inside is painted gloss white and the outside any colour you like. The dimensions shown are nominal only and will probably depend on whatever pipe or bar is available for forming it, however I would not make it any smaller than the size shown, as it does get rather hot.

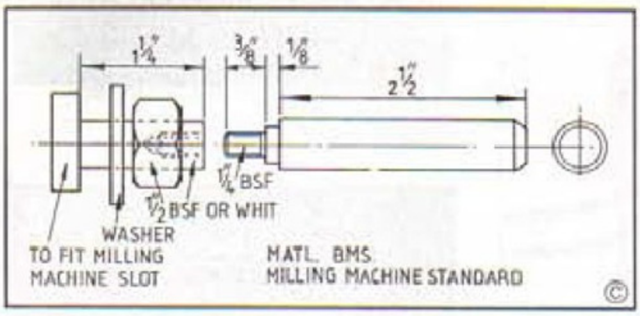
The clamp shown in the drawing is a scaled-up version of the one on a Mitutoyo magnetic stand; the pillar is 14mm but I have omitted the hole dimension on the drawing as it can be to whatever size is required; the dimension Z = 5/32in. should not be exceeded. The knurled nut is shown as ¾in. diameter but this is only because I happened to have one of this size; the diameter could, with some advantage, be a bit larger, alternatively

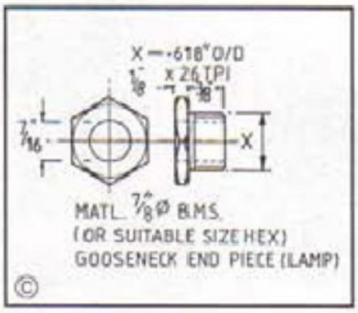


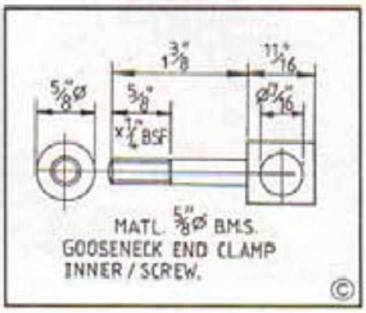


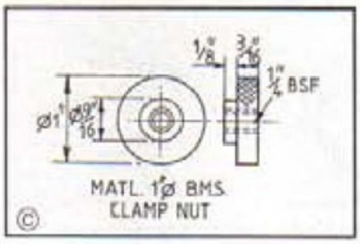


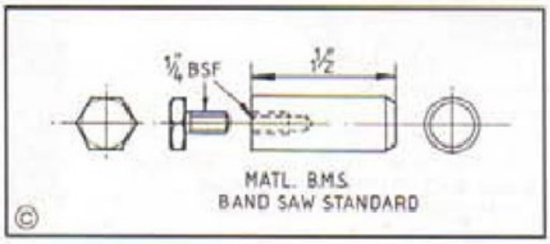


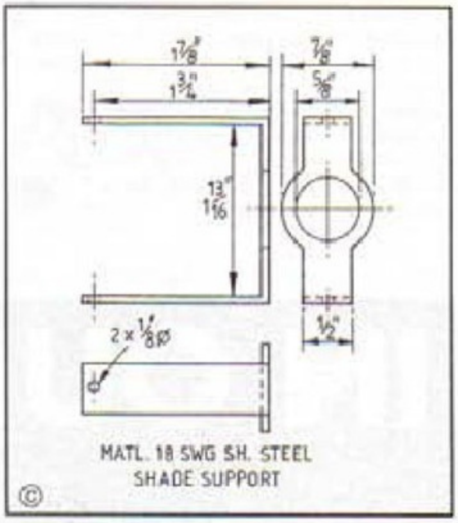


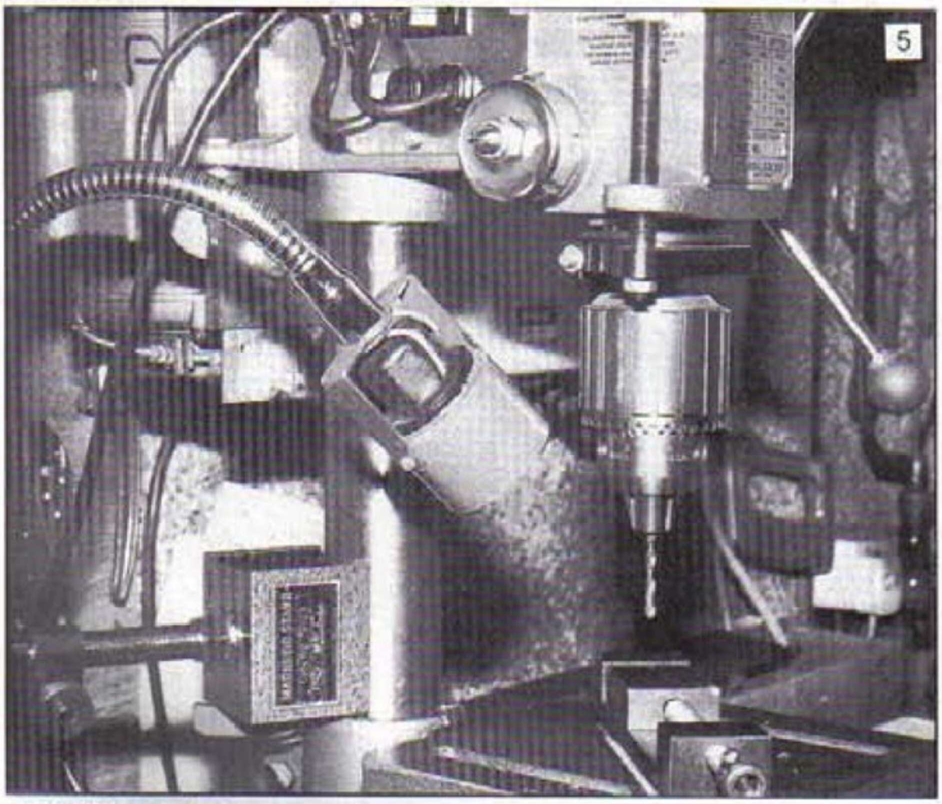




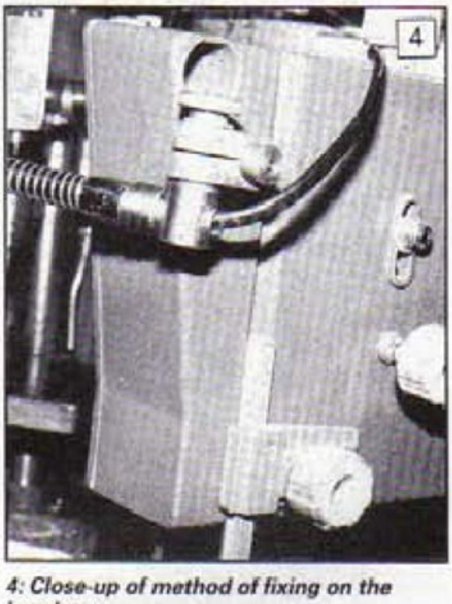








5: The fitting attached to a magnetic stand on the vertical drilling machine.

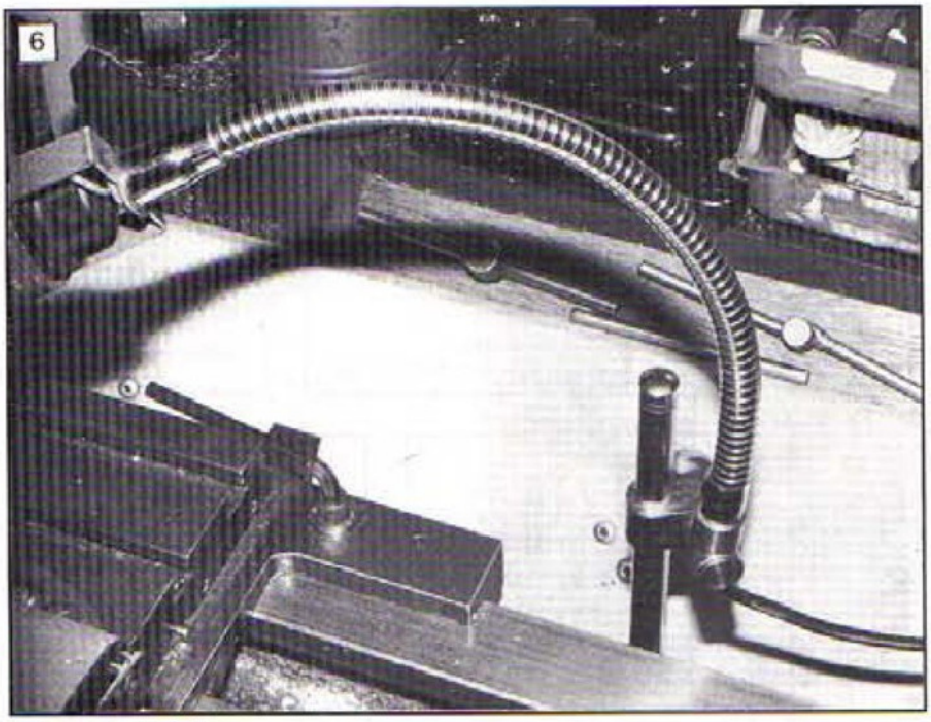


4: Close-up of method of fixing on the bandsaw.

a wing nut could be used.

The standards are very simple; the one on the miller is really only a large bolt and nut drilled and tapped to carry the pillar. If the light is to be used on a bandsaw, a short pillar has to be fitted as shown in the photograph.

A power supply of 12 volt and at least 2 amps is required and there are several options: Bull Electrical and J.A. Crew stock suitable double wound transformers (a *double* wound unit is essential) which should be fitted into a steel enclosure; alternatively you may have a battery charger sitting on a shelf – not earning its keep – that will do nicely. Best of all is one of the transformer/rectifier units, relics of a bygone age when boys and their fathers played with train sets and toy racing cars. These are to be found at jumble or boot sales, mine is a *Smoothflow* by



6: In use on the lathe.

Minimodels Ltd; it is fitted on the side of the bench and supplies a mini drill as well as the lamp, it even has an overload cutout; it cost 50p at a jumble sale, and no haggling! The tail ends of the lamp cable are fitted with two crocodile clips, also obtainable from Bull Electrical. The cable should be at least 5 amp capacity to minimise voltage drop.

Suppliers' Addresses

J.A. Crew & Co., Watery Gate Farm, Dovers Hill Road, Weston-Sub-Edge, Chipping Camden, Gloucestershire, GL55 6QU. Tel. 0386 841979

Bull Electrical, 250 Portland Road, Hove, Sussex, BN3 5QT. Tel. 0273 203500 Fax. 0273 323077.

QUICK TIP

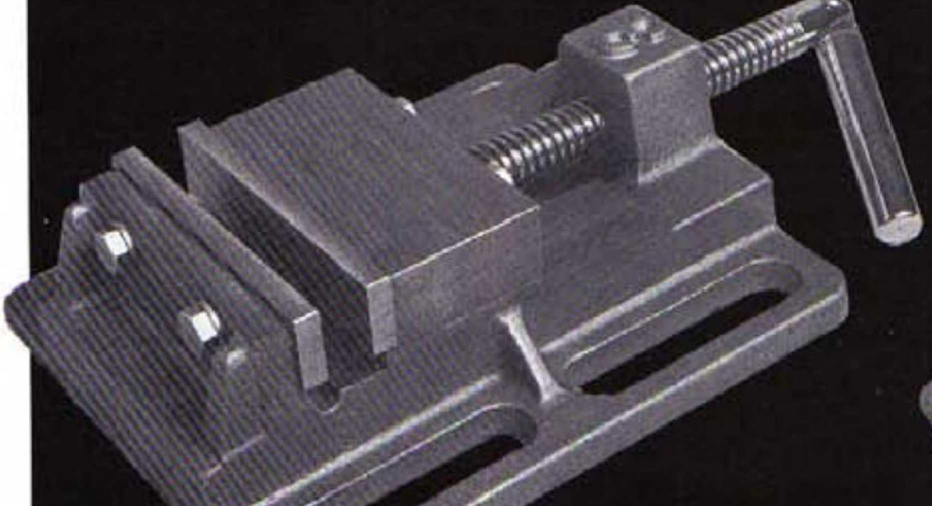
If, when turning between centres, the job is too large in diameter for any of your driving dogs put in its place a worm drive hose clip, replace the catch plate with a faceplate and spigot. The spigot, if positioned next to the clip band, will drive through the tightening screw. It will not slip and there will be no screw marks afterwards.

M.J. Devlin

7: The fitting with lampshade removed.

IN OUR NEXT ISSUE!

Contents may be changed



An article on making and using laps.

Coming up in the MAY/JUNE issue No. 23 will be:

Converting an economy drilling vice into a lightweight milling vice.

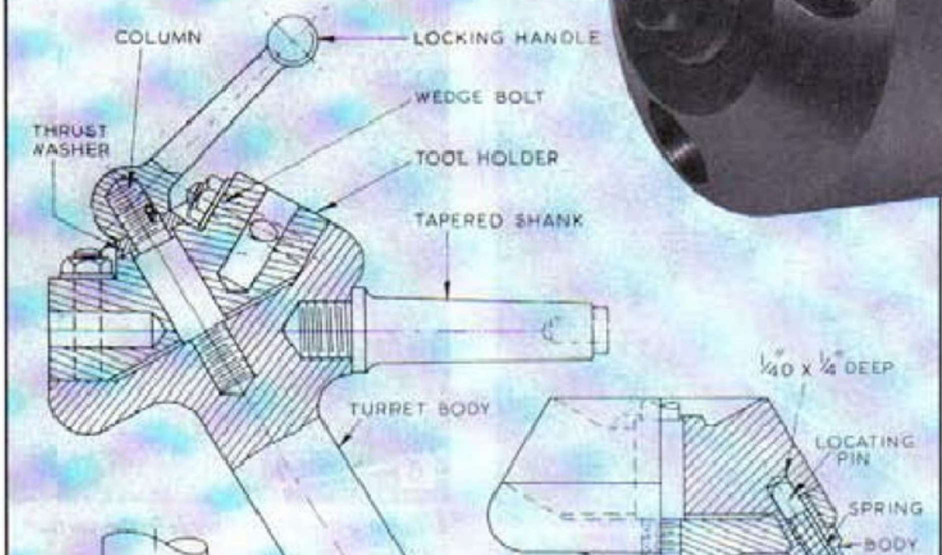
Some thoughts on the methods for the measuring and marking out of angles.

AND MUCH MORE
Issue on sale 22 April 1994

A THREE WAY TAILSTOCK TURRET

This three way tailstock turret is made entirely from stock materials and will provide an interesting project to make. When made, it will probably become an indispensable item of your workshop equipment.

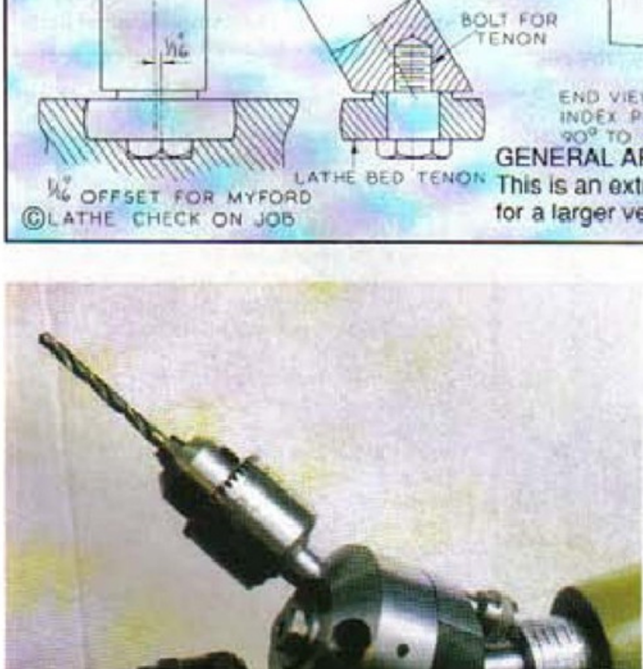
1: The completed three way tailstock turret.



GENERAL ARRANGEMENTS
This is an extract from Plan MM 127 for a larger version. See notes in text.

Any reader who has had to make a batch of turned parts, including the need to be drilled on the lathe will, I am sure, have found the need to repeatedly interchange drill and centre drill quite a chore. To eliminate the requirement, the three way turret, seen in **photo 1**, and described in this article will enable the drill and centre drill to remain on the machine. This can be seen in **photos 2 and 3.** Having a third station, a tap could be included if the parts were to be tapped. Of course this is not the only application for such a lathe accessory.

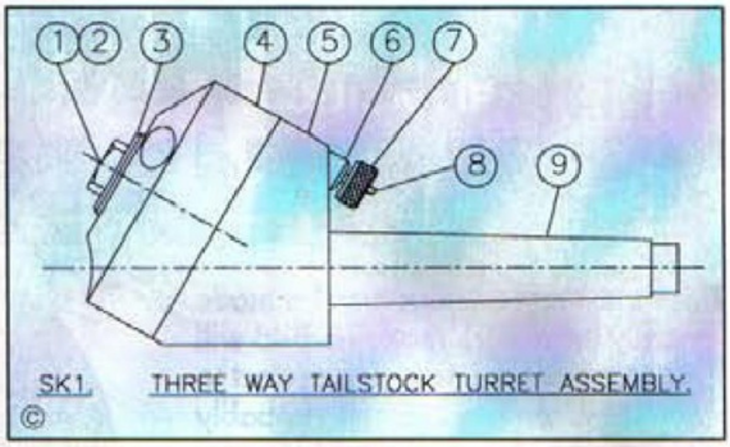
The fact that even more complex operations can be accomplished with such an item is evident by the fact that designs, and suitable castings, are available for six way turrets; more about that later. The one in this article is however made entirely from stock material, in BMS. Other uses for turret positions could be a second size drill, depth stop, box tool, end of bar chamfer or radius tool, die carrier etc.

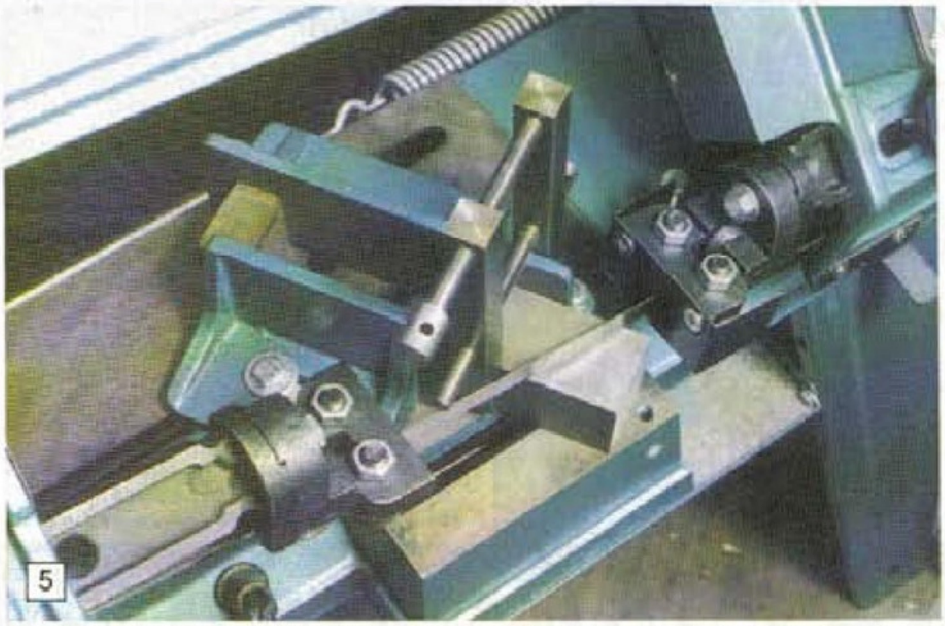


2: Fitted with centre and twist drills. The centre drill is ready for use.

3: The twist drill in position for use.

4: The completed kit of parts.





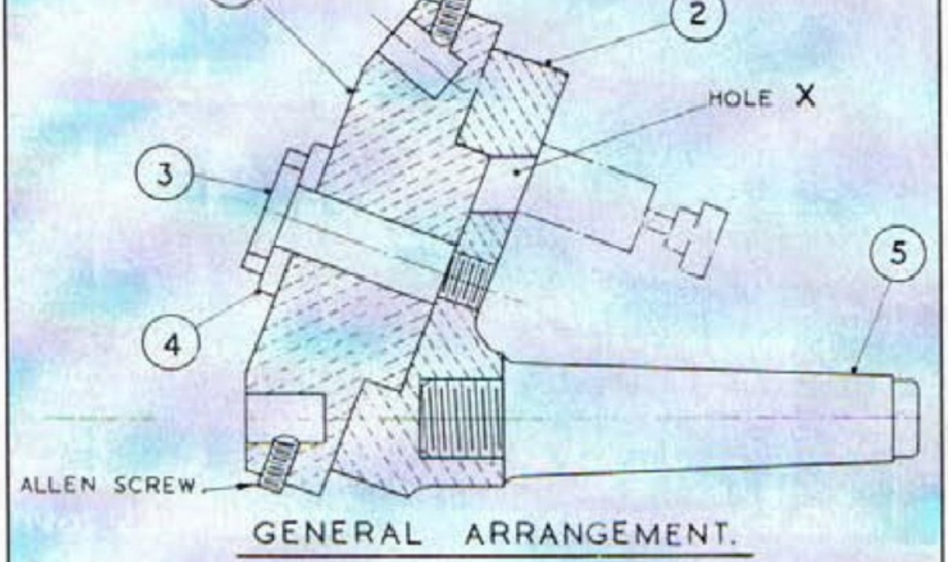
5: Cutting the first angle of the body using the horizontal mode of a universal band saw.

6: Cutting the second angle in the vertical mode.

For those who are likely to make frequent use of the turret, especially if this will be for larger quantities, the six way turrets are well worth considering in preference to the one described in detail in this article. They will be of considerable benefit when making such items as spacers, posts, screws etc. in batches.

Manufacture

Making the turret assembly provides some interesting machining operations, some perhaps a little different to those more normally carried out. As some parts require to be made to either closely fit into a hole in another, or for holes to line up between parts, the order of manufacture is quite important. The complete set of parts are seen in **photograph 4.**



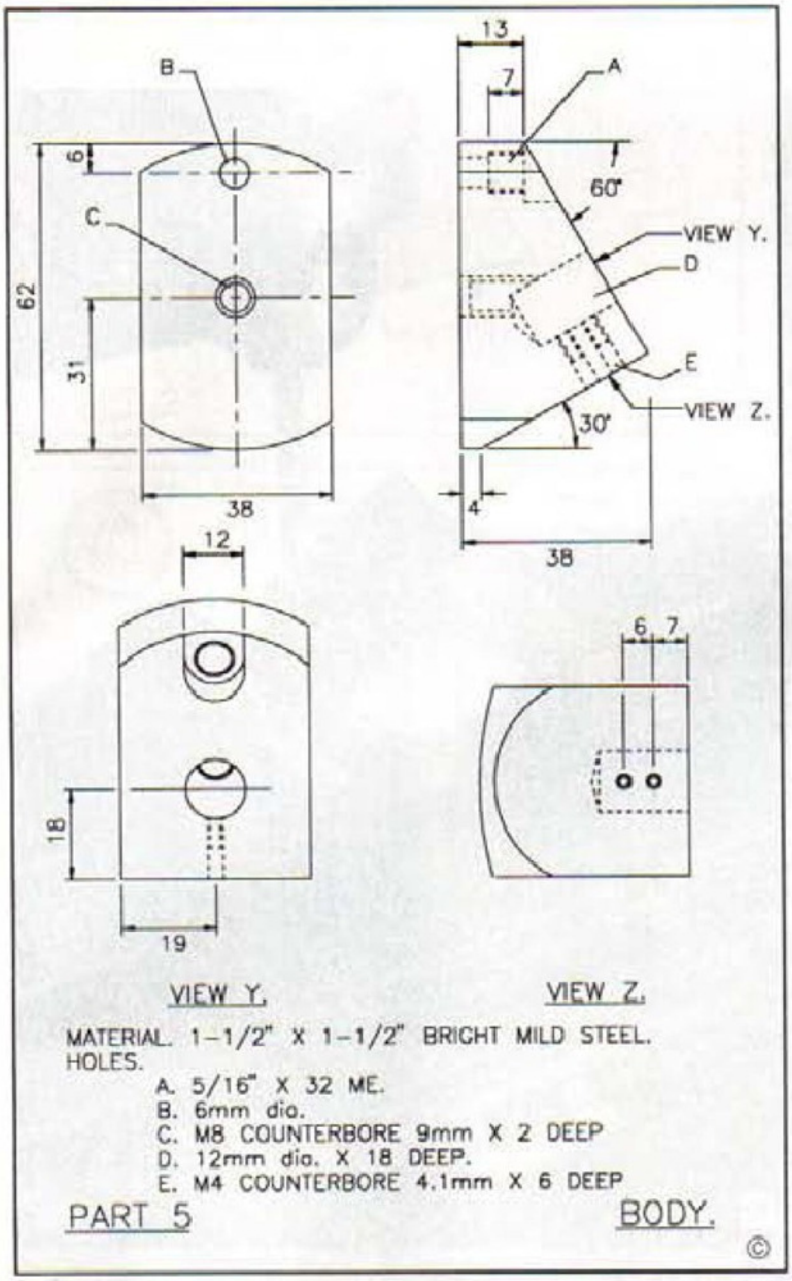
Extracted from Plan WE6 full set from Plans Service – see text.

Body (5)

Start by making the body (part 5) using 1½in. square BMS. This necessitates cutting both the 30 deg. and 60 deg. angles; use a band saw if available **(photographs 5 and 6)** otherwise it will be a case of some hard work with a hacksaw. The part could be made from 2in. x 1½in. material, cutting only the front face but this would be more wasteful as far as material used is concerned.

Having produced the rough cut blank, place it in the milling machine and fly cut the face indicated as view **Y** on the drawing. Do not be overly concerned about the exact angle, any error will be accommodated by the final boring of the holes in the turret. Whilst still in position on the milling machine, drill hole **D,** this will ensure that the hole is truly at right angles to the face and, as a result, the shoulder on the Morse taper will seat properly.

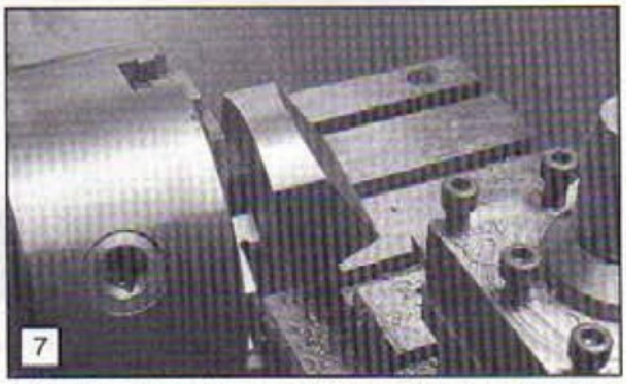
Remove the part from the vice and reposition so that the face just machined can be set at right angles to the table surface, using an engineer's square. With this done, face **Z** can be machined in a similar manner. For those wishing to make this item but not possessing a milling machine, these operations could quite easily be carried out on the lathe. This could either be with the part mounted on



QUICK TIP

Place a square of flyscreen or similar openweave material over the drain screen in the sump, weighted with scrap pieces of steel bar. This helps to stop swarf being washed into the coolant tank. It can be thrown away and replaced when the sump is cleaned.

David Dumble



7: Turning the outer ends of the body to match the eventual diameter of the turret.

9: Making the recess for the plunger spring box.

8: Improving the appearance of the sides of the body.

the cross slide and using a fly cutter, or alternatively mounted on the face plate and faced and bored in that position.

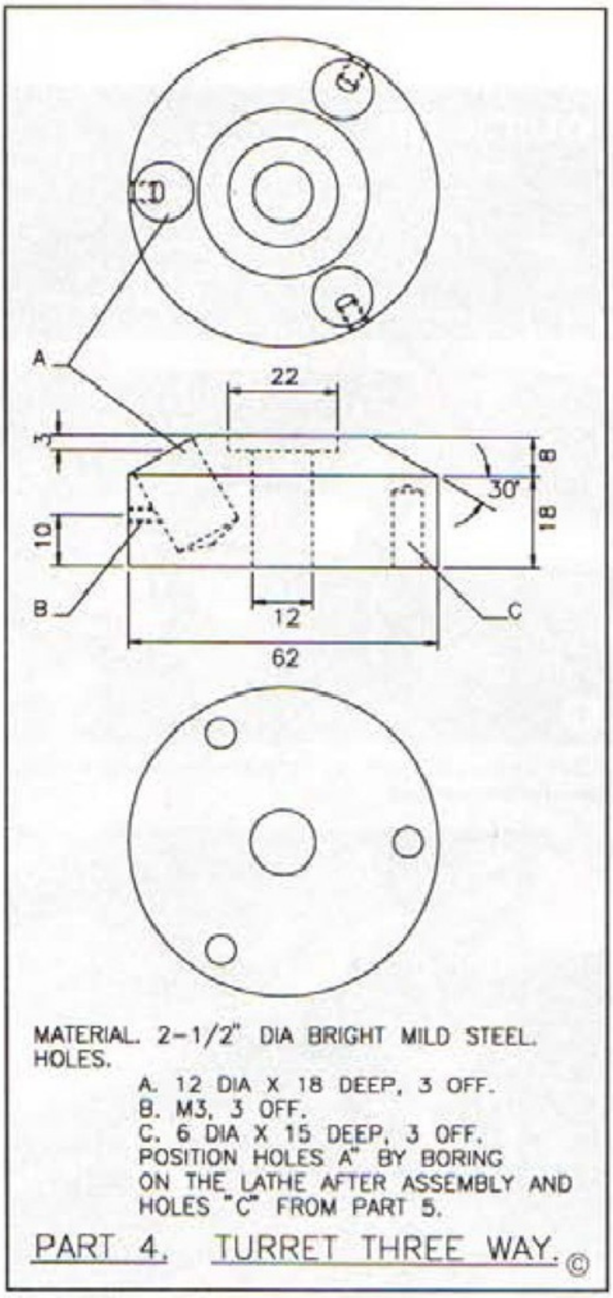
Mark out for all the required holes, drill and tap as required all but hole **A**, drill hole **B** right through and only 5.8mm dia. at this stage. Hole **C** should be at right angles to the face, as this will help to ensure the pivot spindle **(2)** is also at right angles, thus allowing the turret **(4)** to rotate freely.

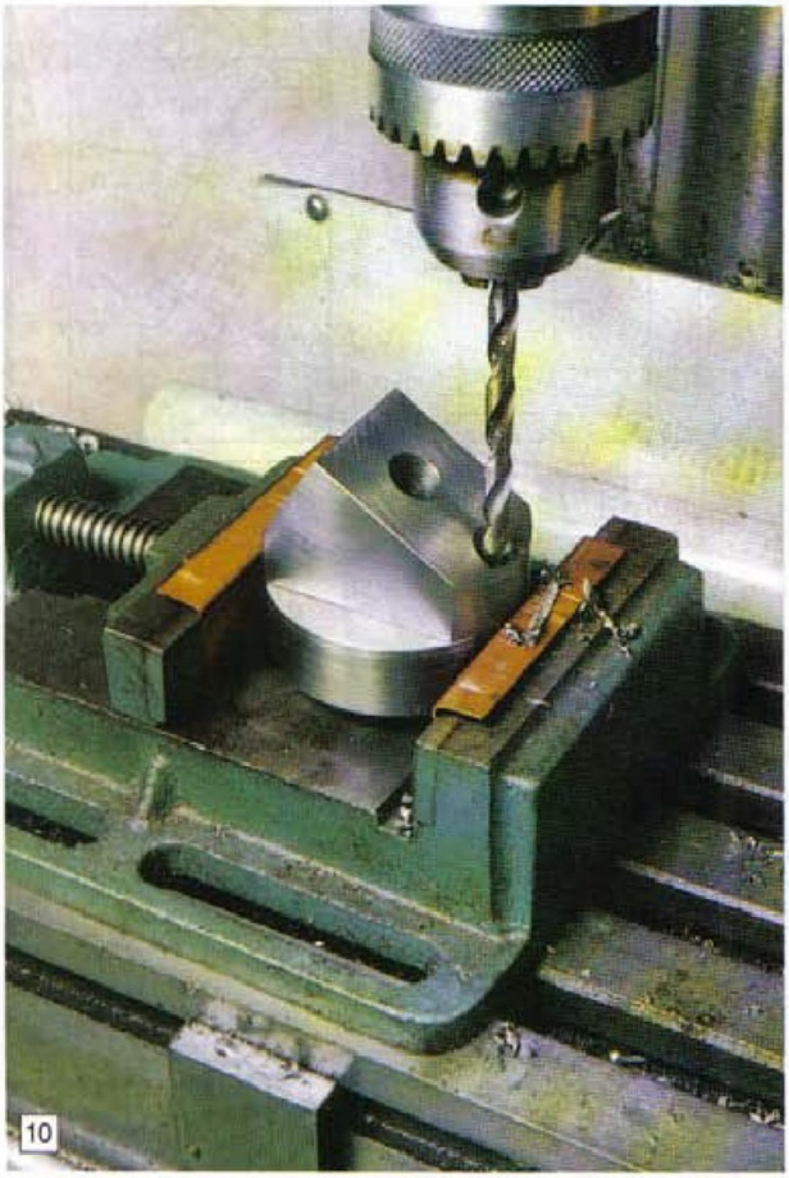
Note the counterbores on holes **C** and **E**, that on **C** will permit the spindle to be screwed into that hole to sit down easily, whilst that on hole **E** will avoid the necessity to tap a deep hole with a delicate M4 tap, whilst retaining adequate strength.

Place a short length of ½in. dia. steel in the chuck and turn down to 8mm over a length of 12mm and thread M8. Screw the body tightly onto this, then loosen the chuck and slide in, so that the body is supported by the chuck jaws. With the body now in position it can be machined to the 62mm dimension, this operation is shown in **photograph 7.** The part being driven by an M8 stud and the cut being intermittent, the operation should be undertaken with due care.

If you are concerned regarding the appearance of the finished unit then the sides of the body can also be fly cut as seen in **photograph 8.**

Return the body to the milling machine and create the recess on which the spring box **(6)** will seat, this operation can be seen in **photograph 9.** Follow this by finalising hole A as 5/16in. x 32 TPI. Finish by lightly chamfering all edges with a fine file.



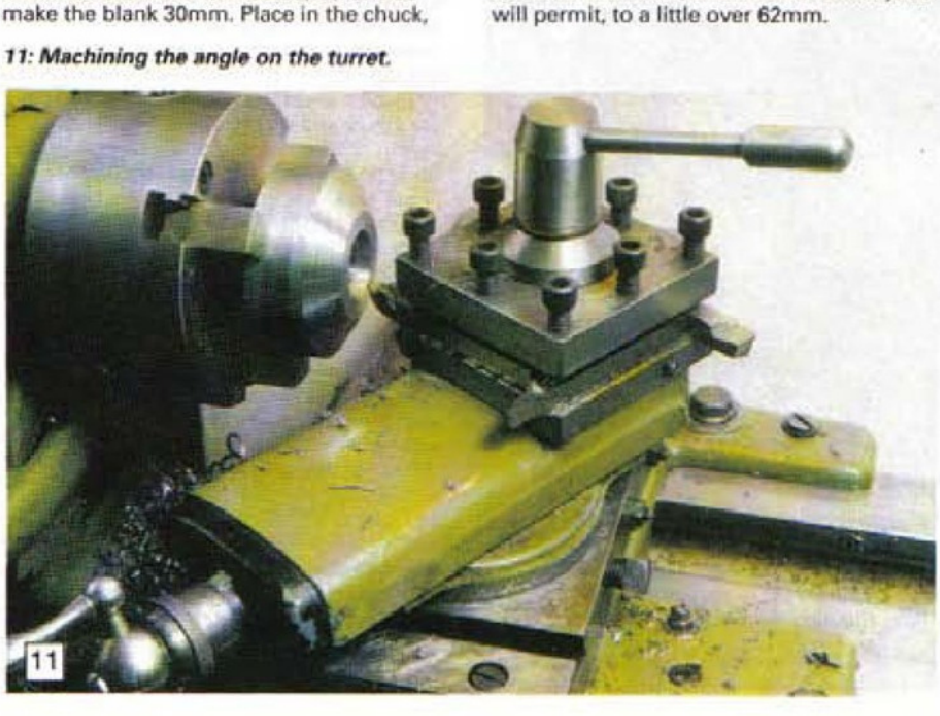


10: Drilling the turret for the plunger.

Three way turret (4)

Cut a blank from a length of 2½in. dia. BMS. If you have a cut off saw which cuts squarely, or you are skilled with the hand held hack saw, then 27 to 28mm long will minimise the material wasted, otherwise make the blank 30mm. Place in the chuck, using the reverse jaws, and machine the face, followed by drilling and boring the 12mm diameter hole. This will ensure the hole is at right angles to the face, as it is the face that will bear against the body. Machine the outer diameter, as far as the chuck jaws will permit, to a little over 62mm.

11: Machining the angle on the turret.



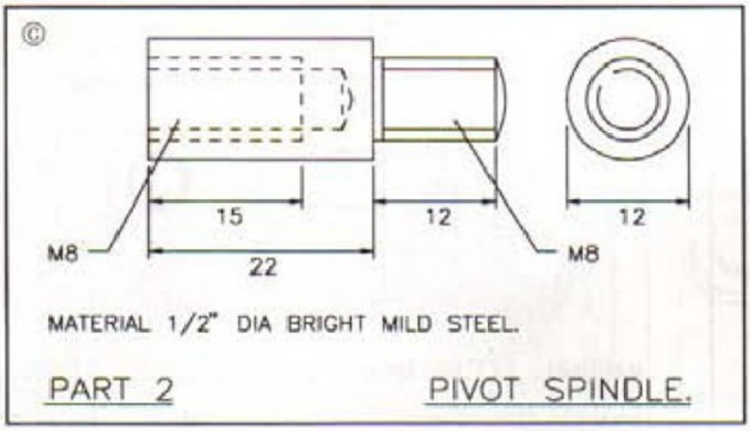
Using the chuck jaws as a reference, assuming a three jaw chuck is being used, mark the outer face with three lines using a lathe tool, these to assist in positioning the locating holes.

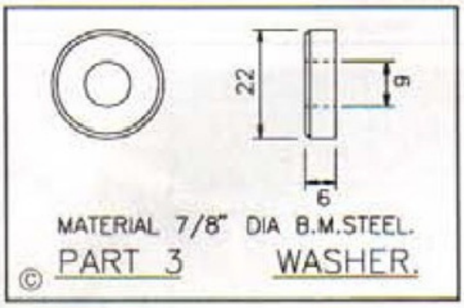
Reverse in the chuck and machine the remaining faces with the exception of the angled one, again leaving them a little oversize for final machining at a later stage. Also machine the 22mm recess at this stage. If your chuck is reasonably accurate then this can be machined to finished size, diameter and depth, otherwise it can be finished when finalising the outer surfaces whilst mounted on a stub mandrel.

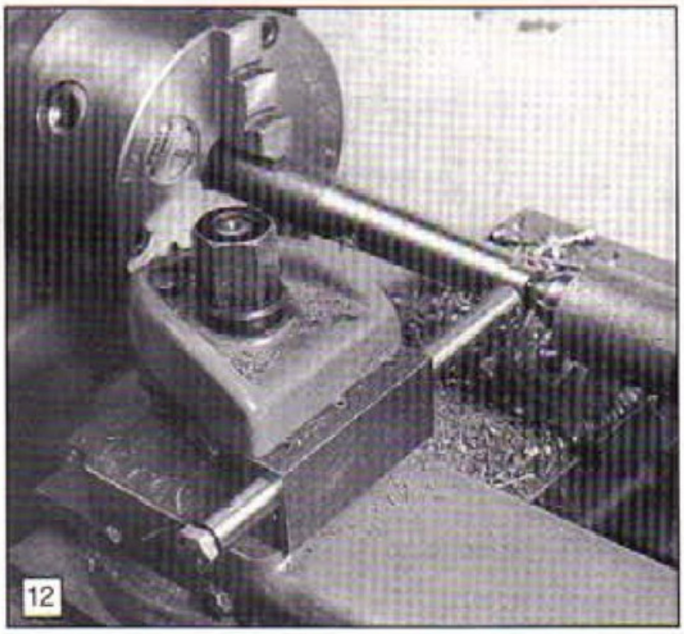
At this stage make the pivot spindle **(2)** and the washer **(3)**. These are quite straightforward, the only critical area being that the 12mm dia. of the pivot must be a very close running fit in the turret.

Screw the pivot spindle tightly into the body and place the turret over the spindle. Position one of the marks on the turret against some suitable reference point on the body, and clamp tightly using the washer and a suitable screw.

Place the assembly in a vice, screw the head down with the head between the central slot, or if this is not wide enough, with two parallels. At this stage the reason for not machining the angle on the turret can be seen, as had the taper have been



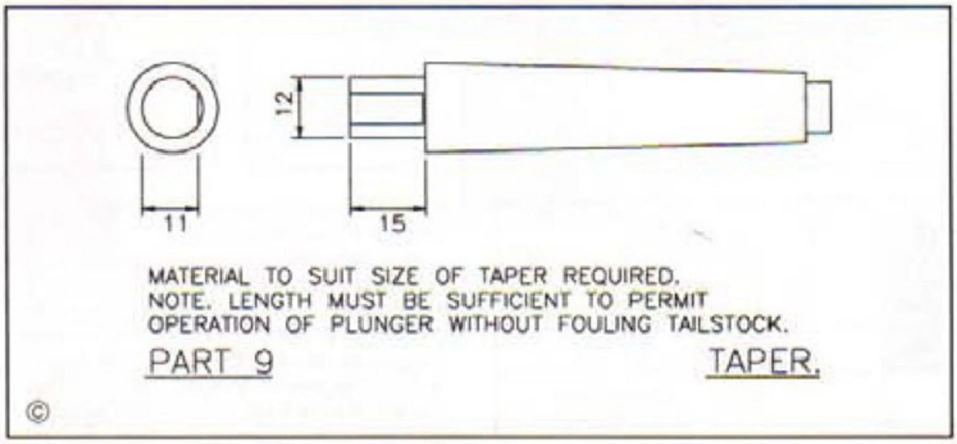


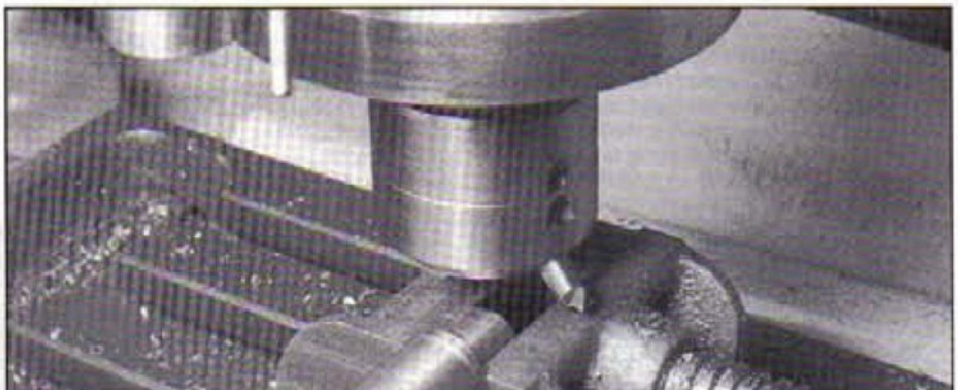


12: Turning the Morse taper. Note the use of a boring tool the enable the top slide to be well clear of the tailstock.

machined, then there would have been no surface suitable for resting on to the parallels. Again using only a 5.8mm dia. drill, drill through to create the plunger hole in the turret as shown in **photograph 10.**

Rotate the turret to the next marked position and drill the second hole in the turret, continue with the third. Exact positioning of these holes is not critical; any departure from the theoretical 120 deg. will be accommodated in the final boring of the turret. After drilling the third hole do not loosen the screw but ream through both body and turret 6mm diameter. Then loosen the screw and ream the other two holes in the turret, each time starting through the hole in the body.





13: About to make the flat on the Morse taper end, a packing piece can just be seen between the jaws at the rear end of the vice. This is included to avoid undue strain on the vice jaws and ensure a secure grip of the taper. A fly cutter was used as it happened to be on the machine, an end mill would be a more usual cutter to use.

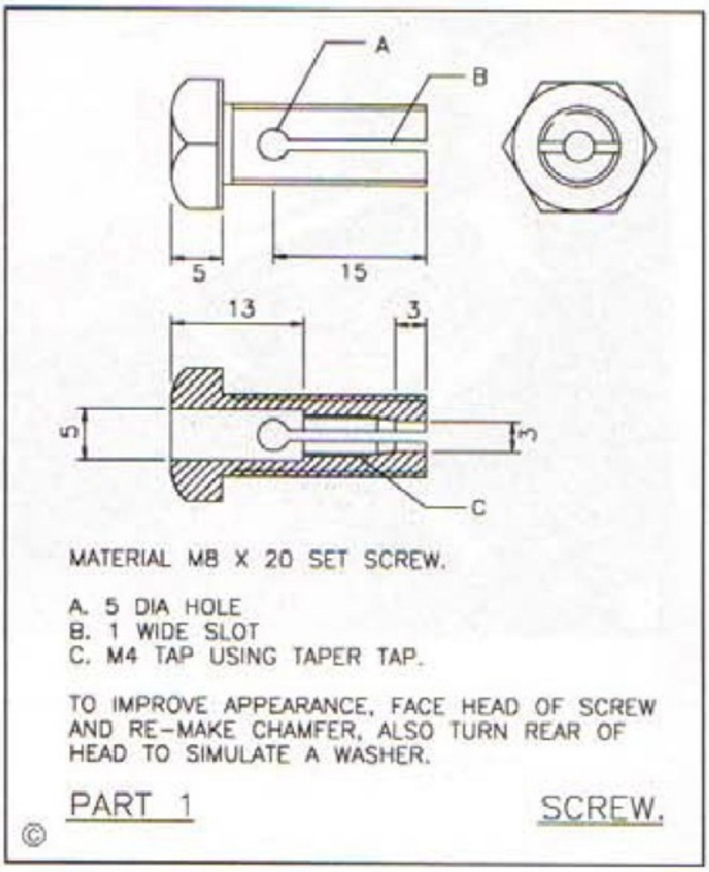
Return the turret to the chuck and machine the angled portion as seen in **photo 11,** again a little over size. It is intended that the turret should be finished whilst mounted on a solid stub mandrel, and this may appear the correct time to do this. If you wish to ensure a reasonable appearance when new, then this will be best left till after other machining operations have been completed.

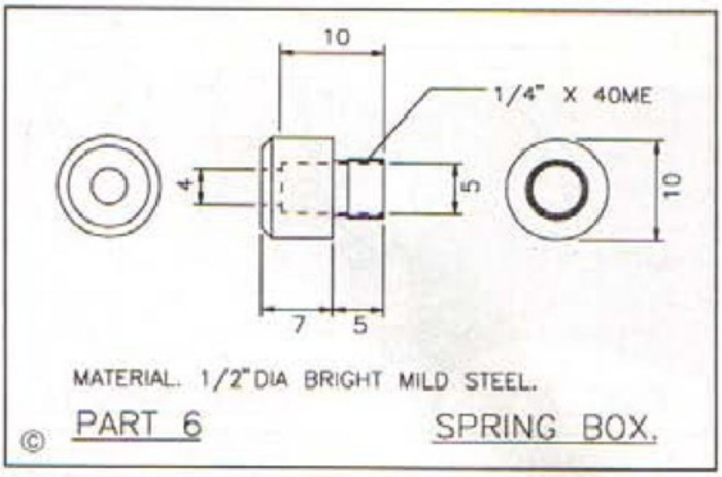
Taper (9)

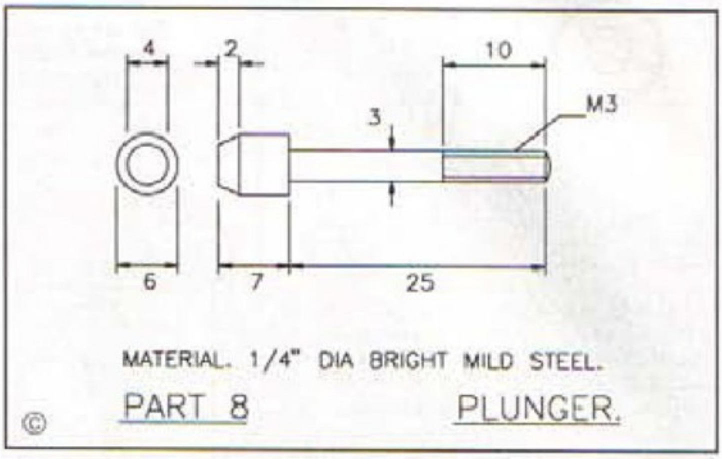
This is not fully dimensioned in the drawings, it will need to be made to suit the machine on which it will be used. Mine is No.2 Morse taper, another consideration is that the length must also be sufficient to permit easy operation of the plunger without fouling the tailstock or tailstock barrel.

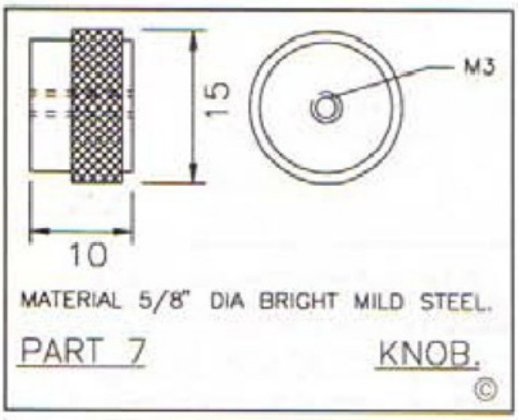
When machining the taper I used the method for setting the top slide as described in the Aug/Sept '91 issue of *M.E.W.* Having set the top slide quite easily by this method, I was pleased to find the resulting taper was acceptable first time, no further adjustments to the angle being required.

Another approach that I tried for the first time was to use a boring tool holder but using it sideways. This permitted the top slide to be set well back and thereby avoiding the tailstock, it being essential to support the taper with the tailstock. With the necessarily long overhang of the tool, seen in **photograph 12,** the depth of cut had to be kept to around 0.1mm, less for









the finishing cuts.

If the headstock has the same taper as the tailstock, the taper can be placed in the headstock for machining the parallel portion. If not, it must be turned at the same time as the taper using a left hand knife tool. Being fixed with screws the fit is not that important, so this approach should present no problem, even though it will not be possible to test the fit prior to parting it from the portion in the chuck. Finish the taper by machining the flat on the parallel portion on which the screws will tighten, **photograph 13.**

Minor parts (1, 6, 7 and 8)

The screw requires some explanation otherwise the remaining parts need no comment. As the turret requires to be rotatable, but with minimum play, some means of achieving this has to be established. Making the length of the pivot spindle to just the correct length, such that rotation without play is achieved, would be possible but considered too likely to fail. Some method of adjustment would be preferable such as lock nuts or perhaps a Nylock nut. The latter was not available whilst the use of two lock nuts was considered visually untidy.

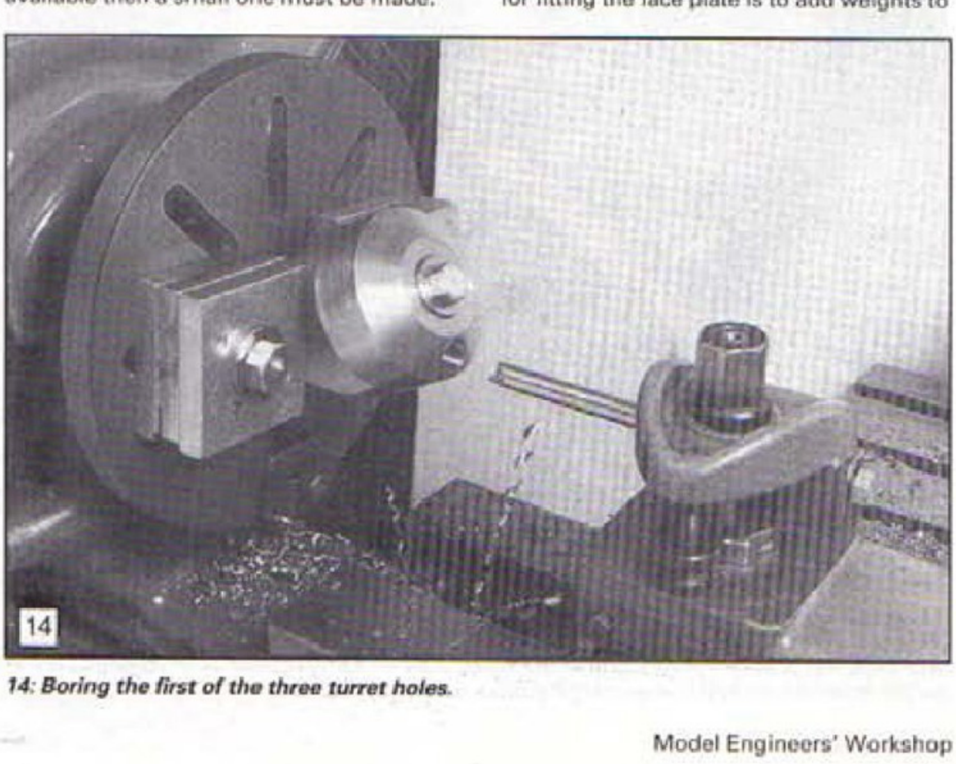
As a result the method of making an expanding screw was adopted, as seen in the drawing. I cannot claim this to be my own idea as I have visions of having seen this previously, maybe even in the pages of *M.E.W.* The essential feature is that it is tapped using a taper tap and not passing right through. Screwing in of a grub screw will therefore tighten the larger screw by expanding it into the pivot spindle. As a result the larger screw can be adjusted such that the turret can just turn without play, then locked using the central grub screw.

The only remaining part is the spring for the plunger, if a suitable spring is not available then a small one must be made.

Boring the turret

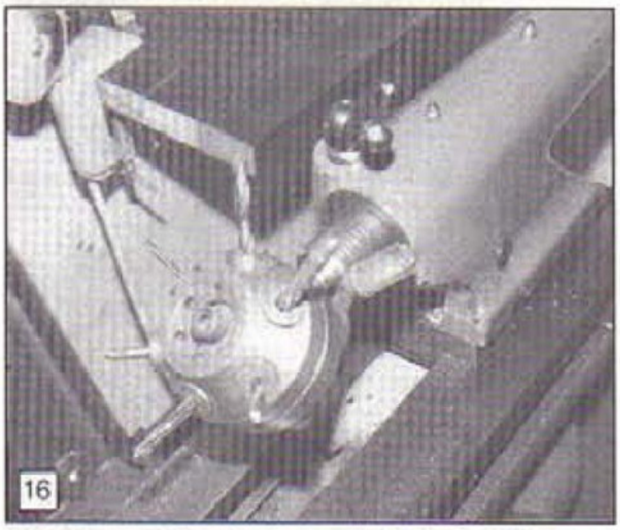
With all the parts now made, although some still require work on them to be finished, the items can be assembled. The operation now to be carried out is to bore the three holes for the various items that will be fitted to the turret. It would be possible to mount the turret assembly into the tailstock and then drill with a drill mounted into a chuck in the headstock. However, a better approach would be to bore this whilst mounted in the headstock, as a more precise hole could be produced by this method.

Fit the faceplate to the lathe and fix the complete assembly into the headstock using the Morse taper. The main purpose for fitting the face plate is to add weights to

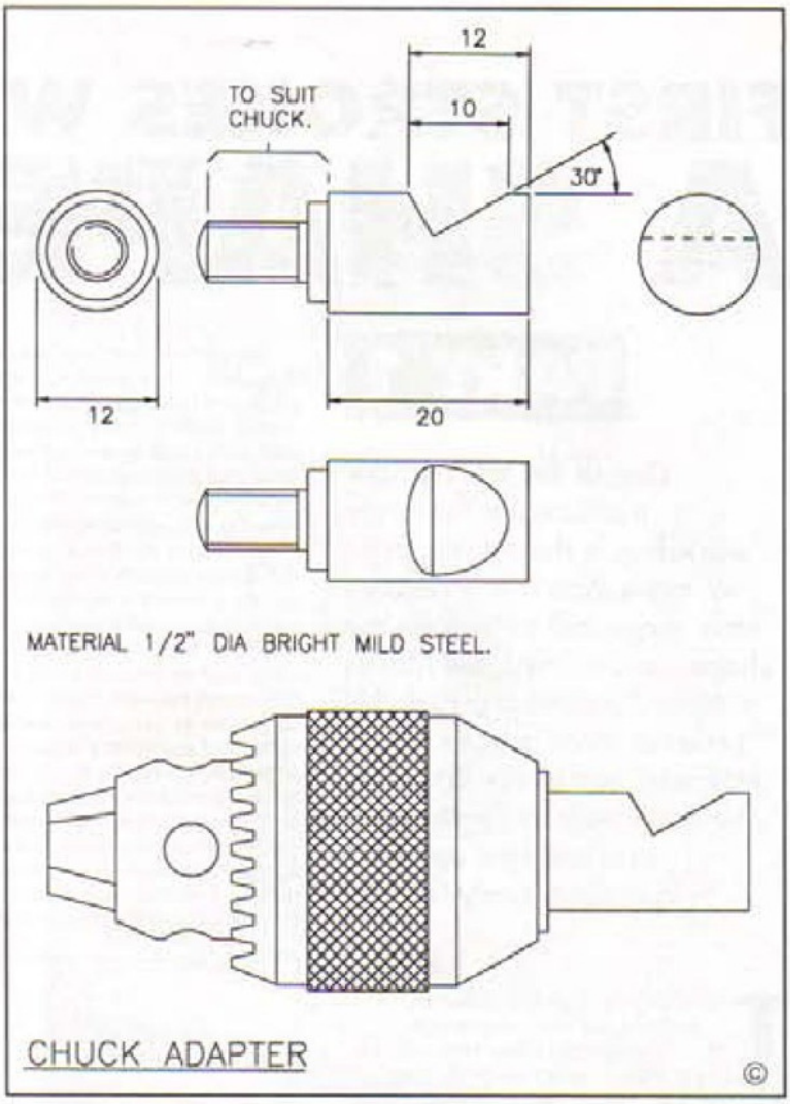


14: Boring the first of the three turret holes.

15: *Two drill chucks, originally from hand drills and now fitted with adaptors for use in the turret.*



16: A six-way tailstock turret as per the design by L.H. Sparey and available on Argus Plan MM127.



overcome the out of balance created by the irregular shape of the turret assembly. Having fitted the faceplate however, use it also to add some extra support to the body of the assembly, this can be seen in **photo 14.** Just visible at the bottom of the face plate is one large tee nut added to counteract the out of balance of the turret assembly.

For this operation the central screw should be tightened fully to achieve maximum rigidity. Centre drill and drill hole A in the turret, but a little undersize, from this point the hole can be bored out precisely to 12mm. Use a hole gauge as described in the article on hole gauges in issue number 15 of *M.E.W.* to test hole size. Having completed the first hole, loosen the centre screw, disengage the plunger and rotate to the second position. Make the second and third holes by the same approach, ensuring all three are, as closely as is possible, the same size.

Finalising the turret

Remove the assembly from the lathe and dismantle. Mark out, drill and tap the remaining three M3 holes. With the main machining of the turret complete make a 12mm stub mandrel and mount the turret on this. *(If in doubt see* M.E.W. *issue 14 page 49 Fig. 3. Ed.)* With the turret in this position on the lathe, the outside diameter, front face and tapered face can all be lightly machined to improve their appearance.

Final assembly

Finally clean all parts and re-assemble, use a little oil on the plunger assembly and the central spindle. Adjust the central M8 screw for zero shake, and lock using the grub screw.

Chuck adaptors

To make full use of the turret a range of tooling will eventually be required, it is however probable that the most likely use will be that of carrying centre drill and a twist drill, as suggested at the commencement of this article.

At least two chucks will be required and it should be possible to purchase those intended for use on portable drills for around £8 to £10. Mine were salvaged from electric drills which had long since been relegated to the scrap yard.

To achieve concentricity both threads and shank must be made without removing the part from the chuck. First turn a short length to gauge the size of the locating recess in the rear of the chuck; when a close fit is obtained measure the diameter and make a note of the value. Now turn down to the required diameter for the thread in the chuck, if you are fortunate enough to possess a suitable die, then produce the thread by this method. More probably you will require to screw cut the thread on the lathe.

Follow this by making the short portion for locating in the rear of the chuck, to the dimension already established. Finally in the lathe, turn the shank to a very close fit in the holes in the turret. It now remains to make the vee shaped recess to take the clamp screw, this can either be made with a file or alternatively on the milling machine. Make one adaptor for each chuck intended to be used in the turret and leave them permanently fitted, as can be seen in **photograph 15.**

Four or six way turret?

Having completed the unit, it would now seem probable that the turret as dimensioned is large enough to have been made four way. If on the other hand, a six way assembly is considered desirable, then either of those shown on plans WE6 and MM127 **(photograph 16)** available from Argus Plan Service, are well worth making, see assembly drawings for MM127 published with this article. A kit of two castings is available from A.J. Reeves & Co. (B'ham) Ltd. for the turret to MM127.

For plans MM127 or WE6. Argus Specialist Publications Plans Service, Argus House, Boundary Way, Hemel Hempstead, Herts HP2 7ST. Tel. 0442 66551. Cost MM127 – £3.00 plus £1.00 p&p and WE6 - £3.00 plus £1.00 p&p.

For castings. A.J. Reeves & Co. (B'ham) Ltd., Holly Lane, Marston Green, Birmingham B37 7AW. Tel. 021 779 6831, Fax. 021 779 5205.

QUICK TIP

Turning eccentric diameters on a bar is easy if the bar is mounted in a small three jaw chuck which is then mounted in a four jaw chuck.

David Dumble

FIRST STROKES WITH A SHAPER

PART 1

One of the less popular machines in the home workshop is the shaper. Even so, more than a few readers have requested articles on the shaper and its uses. Bill Morris of New Zealand provides this series of three articles on the machine. In this, the first part, he deals with its construction and setting it up in the workshop ready for use.

The lathe has been the queen of machine tools for many centuries. Certainly, the lathe was known to the Greeks and there is good evidence that they were able to turn at least small mechanisms in bronze. Of the other general-purpose machine tools, Vaucanson's beautiful little horizontal drilling machine of about 1750 has survived. In the late 1830's at more or less the same time, machines for producing plane surfaces on relatively small workpieces were constructed, the milling machine in America and the shaping machine in England. The shaping machine's immediate ancestor was the planing machine; and Matthew Murray, Joseph Clement, Richard Roberts and James Fox all produced examples in the first twenty years of the nineteenth century. With the exception of Fox, all had worked under the great Henry Maudslay and after Maudslay's death in 1831, the youngest of his pupils, James Nasmyth, set up a factory outside Manchester at Patricroft, producing machine tools for others.

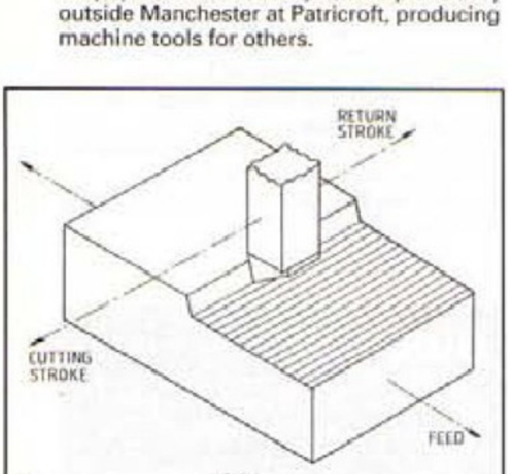


FIG.1

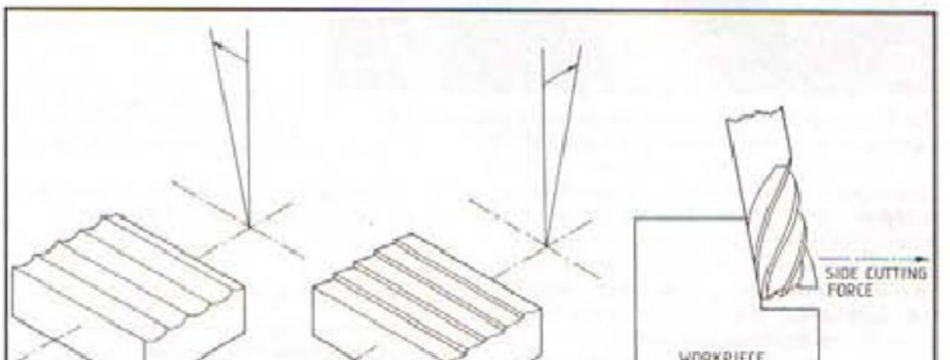
The planing machine was adapted for producing large plane surfaces on heavy parts, but its large table with its great inertia, made it quite unsuited to producing relatively small plane surfaces. Nasmyth's response was to produce his famous "Steam Arm" shaping machine in 1836 *(see Fig.17 page 60 issue 20)*. In a planing machine, the worktable with attached workpiece reciprocates beneath a single point tool and the tool is fed across the table to generate a plane surface. Nasmyth reversed this configuration so that a single point tool reciprocates and the workpiece is fed across beneath the tool **(Fig.1)**. It immediately became a best seller and has remained essentially unchanged in principle, though hydraulic drive has tended to replace mechanical drive in larger present-day machines.

Once they have acquired a lathe, amateurs nowadays will tend to buy a drilling machine as their second machine tool or a mill/drill if the pocket will stand it, since the mill/drill can double as a drilling machine and vertical milling machine, as it did for me for many years. The mill/drill can produce plane surfaces as well as plain slots. With a certain amount of wangling and expense, it can produce tee slots and inclined surfaces like dovetails and vee's. In fact, it can do anything that the shaping machine can do as well as drill and make slots that are blind at both ends. Why then should anyone want a shaping machine?

Consider what happens when a vertical mill generates a plane surface using an end mill. *If (a)* the column is perfectly at right angles to the plane of the table movements and *(b) if* the column does not flex when taking the cut and *(c) if* the end of the cutter is still flat or concave and *(d) if* the cutter is still sharp, then a plane surface of very good finish will be produced.

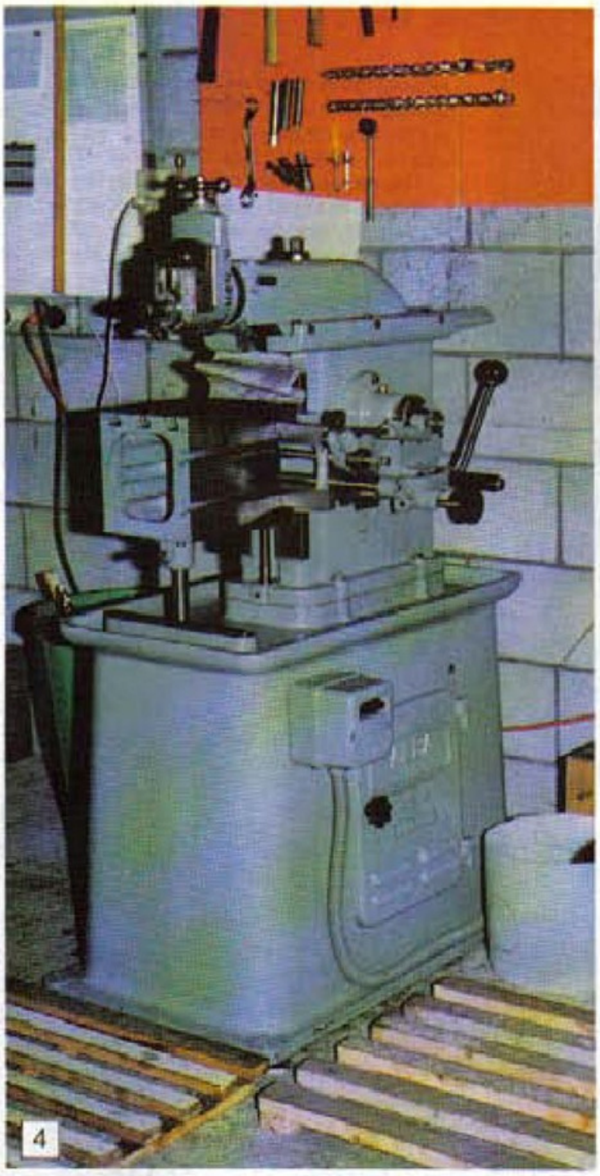
Now consider what happens if the column is leaning to the left or right. As the table traverses, the cutter will produce not a series of adjacent flats but a series of concave elliptical grooves **(Fig.2a)** while if the table is leaning forwards or, more likely under cutting load, backwards, a series of flats will be produced, but not in the same plane **(Fig.2b)**. When the end of the cutter is not flat or concave, its form will be reproduced on the workpiece and as it usually wears convex, the grooves will be concave. When in a hurry I have ground the end of a slot drill off hand (it probably then did all the cutting with one tooth), but you can't do this with an end mill and you need a cutter grinder to do the side teeth.

To produce a plane surface at right angles to the top, either the side of the cutter must be used or the workpiece repositioned for a second operation with the end teeth. With a light machine a good finish depends on the cutter being sharp and well centred in its holder and the cut being light. It is however very difficult to ensure that the vertical surface is truly at right angles to the top surface as the cutter tends to angle away from the workpiece as the column of the machine flexes under the side cutting load **(Fig.2c)** and the depth of the vertical surface is limited by the reach of the cutter. As deflection of a loaded beam held at one end is proportional to the cube of the length, the problem gets very rapidly worse as the extension of the column and of the quill increases. If, as is often the case, the cutter is not well centred, the cut will tend to be intermittent and the finish poor.



EFFECT OF MISALIGNMENT OF MILL–DRILL COLUMN

With the shaper, a single point tool moves backwards and forwards on the end of a ram which is a good deal more substantial than the bed of many an amateur's lathe. On the forward stroke, material is removed in a strip from the upper surface of the workpiece and on the backward stroke the work is fed across, ready for a further strip to be removed on the next stroke, so generating a plane surface. The work can also be fed upwards with each stroke or the tool fed downwards to generate a surface at right angles to the horizontal surface **(Fig.3)** and the tool can be fed at an angle on its own slide to generate inclined surfaces, with the depth of the vertical or inclined surface being essentially dependent on the travel of the tool slide. The flatness of the surface depends on the condition of the ram slides and table slides, but since the former is of large area and the latter move slowly and



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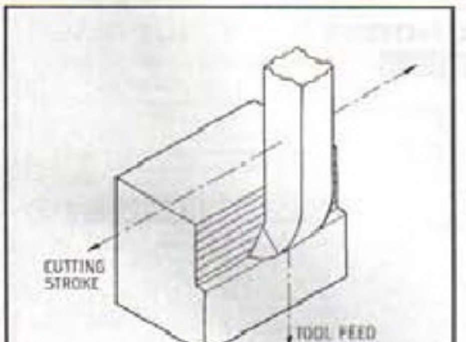


SHAPING VERTICAL SURFACE
FIG.3
©

are not under load when doing so (unlike the milling machine), even an old machine can show little sign of wear on the slides. Rather like with a lathe, the surface finish depends on the condition and shape of the tool tip, which if worn is easily reground. Of course, the ram, table and slides deflect under load, but the combination is a good deal more rigid than the weak link in a light drill/milling machine, the vertical column.

The shaper can be used for segmental work like cutting gear teeth, but a milling machine does the job more easily though the cost and labour of producing the form tool may put many people off. You cannot cut internal keyways with a milling machine but can do so easily with a shaper and a shaper will also cut external keyways that are blind at only one end, providing a hole is drilled to accommodate the tool at the blind end (I have read that if you drill two holes close together at the ram end to let the tool drop into, you can do keyways blind at both ends, but I have never had the courage to try).

To a large extent, the vertical milling machine has displaced the shaper as the relative cost of end mills and slot drills has fallen and this seems to have lowered the price of secondhand shaping machines, so that it is now possible to acquire one in good condition for £200-£300, compared to around £800 for a new mill drill. It won't drill holes or make blind ended slots, but it will produce superior plane surfaces to the vertical mill.

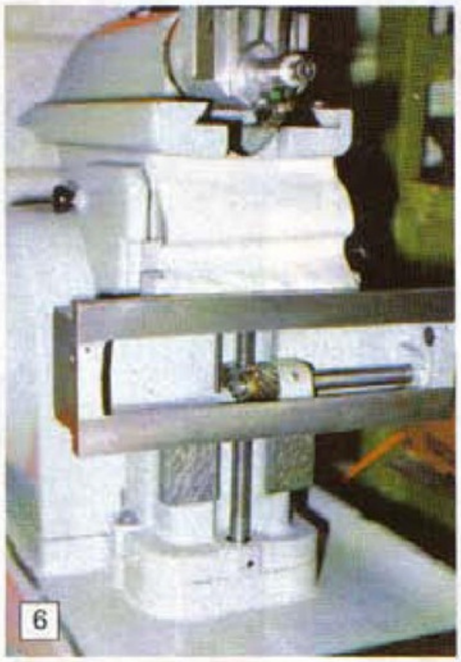
On balance for the amateur, the shaper is the machine par excellence for generating plane surfaces and the milling machine for forming segmental work. For other classes of work each machine has to have its compromises. The shaping machine is often seen as a rough work horse for ripping off metal in quantity, but properly adjusted it is a precision tool capable of working to about the same limits of precision and surface finish as a lathe.

I have been fascinated by the versatility of the shaping machine ever since I first saw one at work about twenty years ago and eventually acquired a second hand one for myself **(Fig.4).** The Alba 1A is typical of many small shapers. Mine looked particularly well when I bought it having obviously had a professional paint job and many of the rotating parts which do wear in a shaper having been replaced. The original scraper marks were clearly visible, suggesting that the slides had worn very little. However, before using a newly acquired machine for the first time, it is as well to thoroughly acquaint yourself with its structure and layout and then to do some tests of alignment, correcting any errors as required. To use a perfectly aligned machine tool of any sort is a joy as, barring human error, jobs will usually come out right first time. To use a badly worn machine which cannot be got into correct adjustment, and kept there for more than five minutes at a time, is to know the frustration of doing a job several times with it coming out right seemingly at random. Let us start with a conducted tour of the general structure and layout of an average small shaper.

Shaper construction

While you can mount a shaper on a bench, it would have to be an unusually substantial one and most amateurs are likely to be offered one mounted on its own cast iron base. This serves the obvious purpose of being a mounting for the machine and usually for its drive motor. It also serves as a support for the outboard end of the table, in the case of the Alba, via an adjustable peg leg. The surface on which the peg leg slides must obviously be in a plane parallel to the cross movement of the work table and will usually have been machined at the same time as the surface for the base of the shaper body. A less obvious function of the base is to act as a vibration damper and the cast iron of which the heavy base is made is particularly effecting at damping. Nevertheless, you would be very ill advised to install it in your spare upstairs-room-cum-workshop as it does vibrate, albeit at a low frequency, and its great weight may well cause it to turn up unexpectedly in the kitchen.

The body is a heavy cast iron box which contains the mechanism for converting the rotation of the motor to the reciprocation of the ram. On its front surface are ways for the vertical slide **(Fig.5)** and accurately at right angles to the plane of these ways on the top of the body are the ways for the ram. Generally, the vertical ways are flat rather than dovetail since dovetail slides would tend to have a wedging action under the cutting forces, but the ram invariably moves on dovetail slides. The vertical slide has cross ways machined on it which are in their turn accurately at right angles to the line of movement of the vertical slide. **Figure 6** shows how the slide is moved up and down. A detachable handle on the right of the slide rotates a shaft on the end of which is pinned a helical gear. This rotates its matching gear which is free to rotate but is held captive in the slide. It is internally threaded to fit on a vertical Acme thread screw which is held captive in the base of the machine and prevented from



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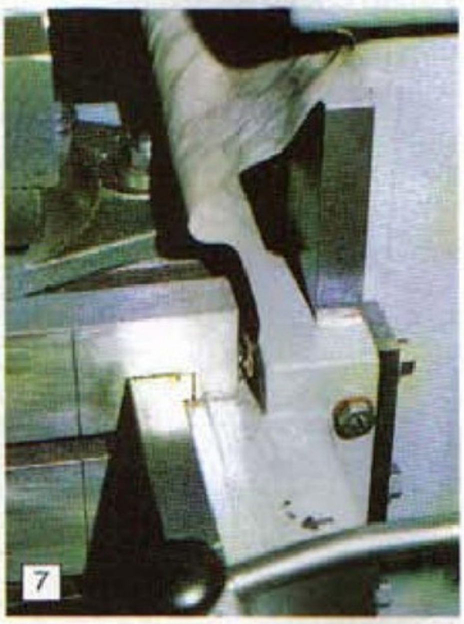
rotating by a grub screw. Thus, as the gear-nut rotates, it climbs the stationary screw, raising the slide as it does so.

A work table in the form of a hollow cube is mounted on the cross ways and traversed by an Acme thread lead screw passing through a nut let into a hole bored in the back of the table. Both slides have gib strips for adjustment **(Fig.7)**. Many shapers, including the Alba 1A, allow one to rotate the table on its horizontal axis in order to shape large angular surfaces. The arrangement for doing this is clearly shown in **figure 16** as well as the assortment of tee slots for attaching the work piece or vice to the table.

The ram is a very heavy box section iron casting moving in dovetail ways on the top of the body and the ways are adjusted for wear by a very heavy gib. A circular seat is machined in the front end of the ram to accept the tool slide base which can be rotated 90 deg. either side of the vertical and locked in position by means of the squared shaft **(Fig.8a)**. The dovetailed tool



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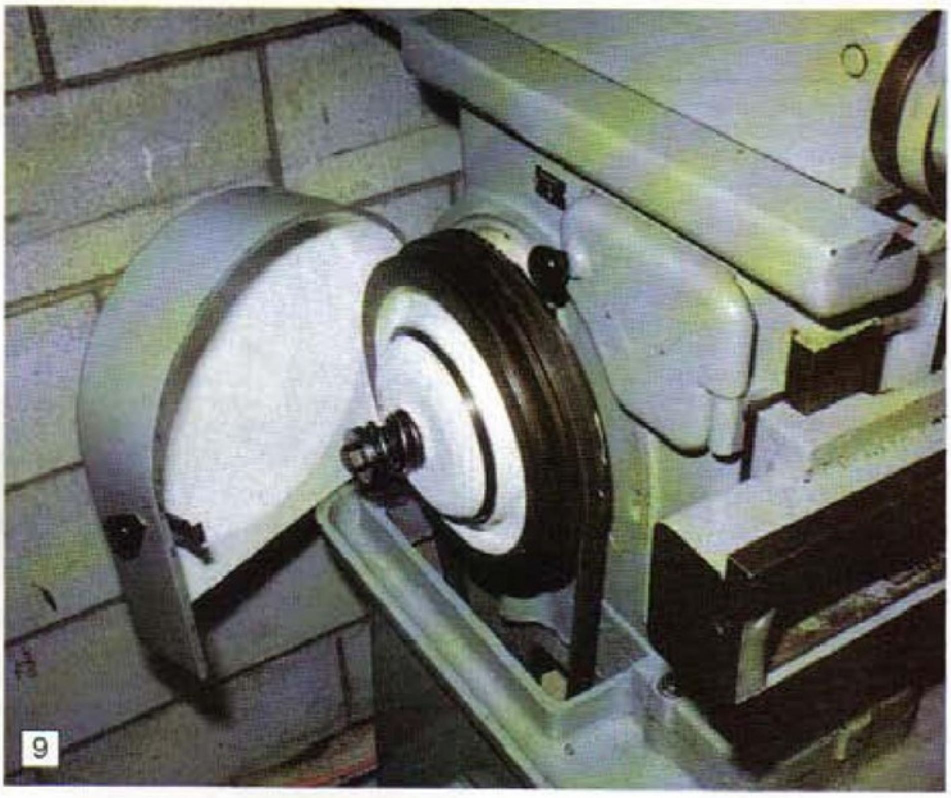
slide is traversed by a feed screw with graduated thimble and is very heftily built.

The tool or clapper box is mounted on the tool slide and as **Fig.8a** shows, it is hinged in such a way that on the non-cutting, backward stroke of the ram, the tool is free to swing forwards and off the workpiece, rather than dragging across the surface. As it re-seats itself for the forward cutting stroke it makes a clapping noise. When shaping vertical or inclined surfaces, the axis of the clapper box can be inclined about 20 deg. either side of the axis of movement of the tool slide so that the tool again swings away from the surface on the return stroke **(Fig.9)**.

The drive

Belt drive from the motor in the base drives a large pulley running free on bearings mounted on the left hand side of the body **(Fig.9)** and a cone clutch operated by a lever on the right hand side transmits the drive via a simple gear box to a large gear wheel, the stroke or bull wheel. The small door seen in **Fig.9** opens to reveal the means of adjusting the length of stroke of the ram **(Figs.10 and 11)**.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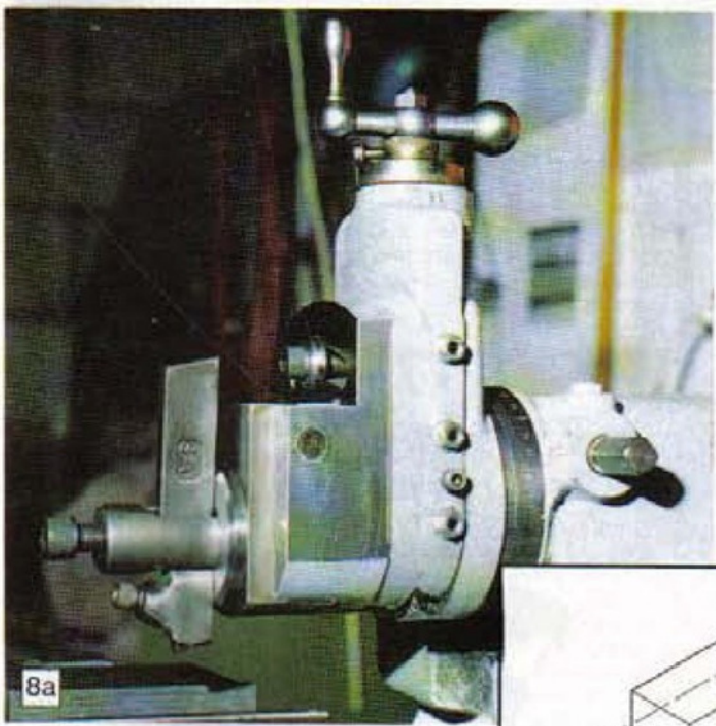
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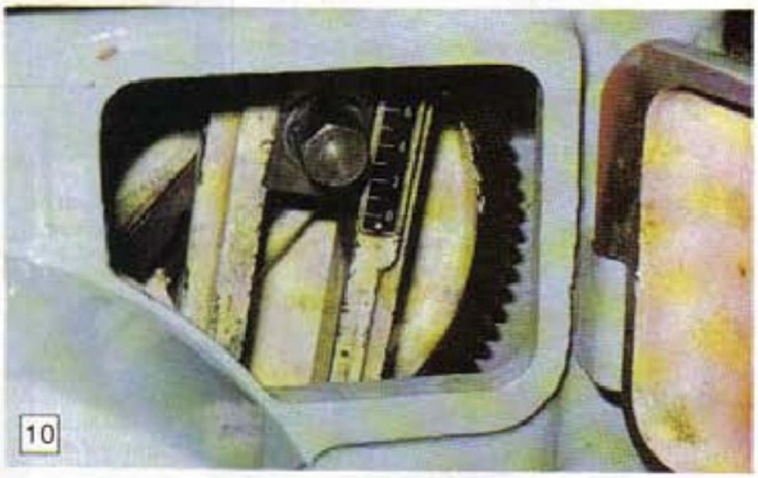
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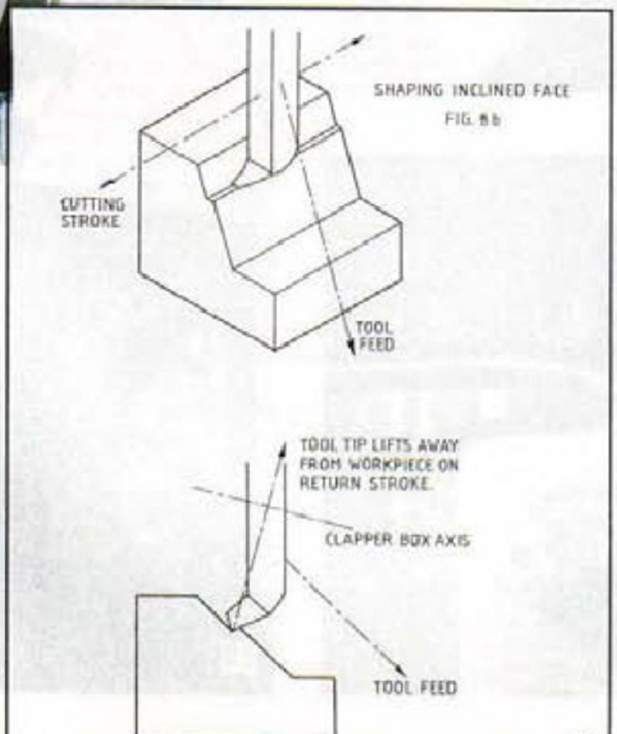
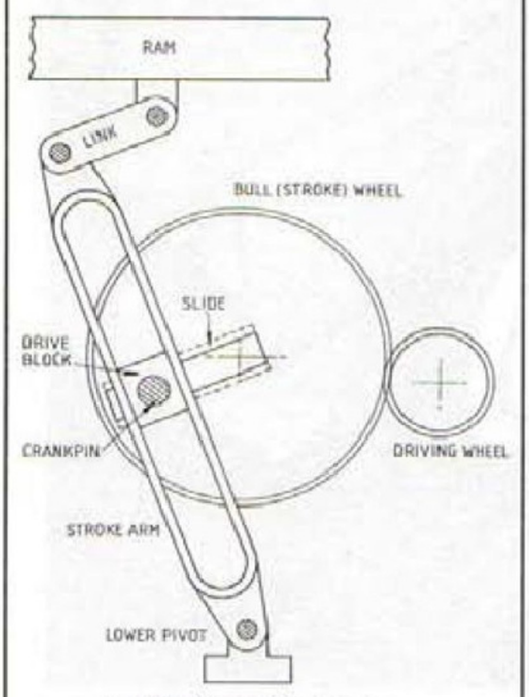
A heavy dovetail or tee slot is machined on the face of the bull wheel allowing a hardened hollow steel crank pin to be adjusted and locked in position along a radius of the bull wheel by means of the nut shown. A drive block is free to rotate on the crankpin and slide on ways formed in the stroke arm, the bottom end of which is free to rotate on a shaft, **Fig.11.** The upper end of the stroke arm is attached via a short link to the ram. Thus, as the bull wheel rotates, the drive block causes the upper end of the stroke arm to reciprocate, the drive block sliding up and down as it does so. Without the short link the stroke arm would try to move the ram in an arc, but in the Alba 1A, there is no need for the upper link as the bearing in the lower end of the stroke arm is in the form of a fork.



QUICK TIP

If your 3 jaw chuck is as good a fit on the lathe spindle as mine this idea may help. I grip the nose of my rotating centre in the chuck jaws and slide the tailstock up to the spindle. Alignment is thus automatic and the chuck can be screwed on effortlessly.

P. Wilton



STROKE MECHANISM OF SHAPER
FIG. 11

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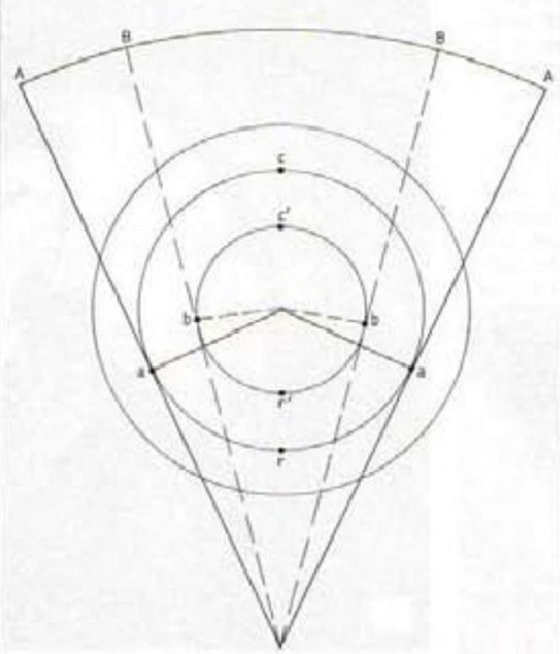


GEOMETRY OF STROKE MECHANISM
FIG. 12

©

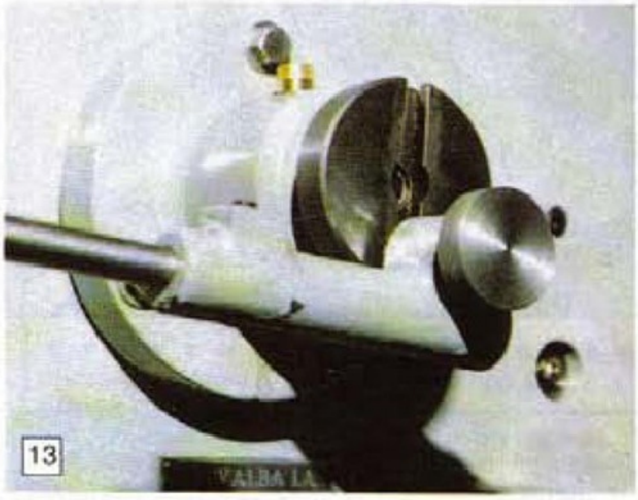
QUICK TIP

To true up a disc in the chuck, tighten the chuck lightly and then fit a soft metal bar in the toolpost. Press it against the disc while the chuck is rotating slowly until the disc is running true, then tighten the chuck.

David Dumble

Never allow aluminium and steel to be stored together or used together structurally. If the metals are allowed to become damp they will, due to electrolytic action, have a corrosive effect on each other.

Alan Jeeves



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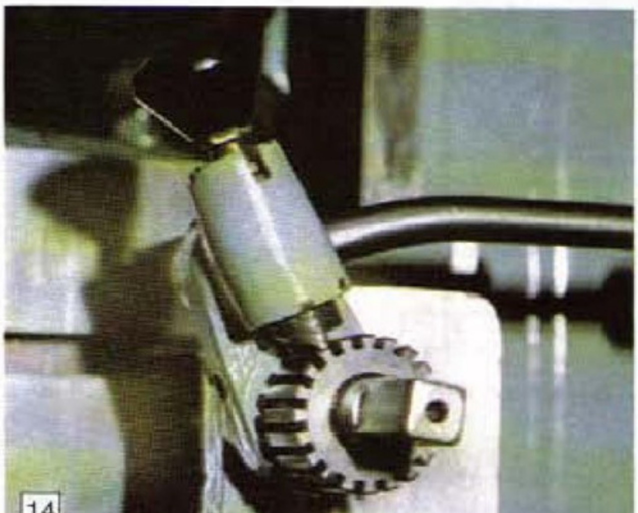

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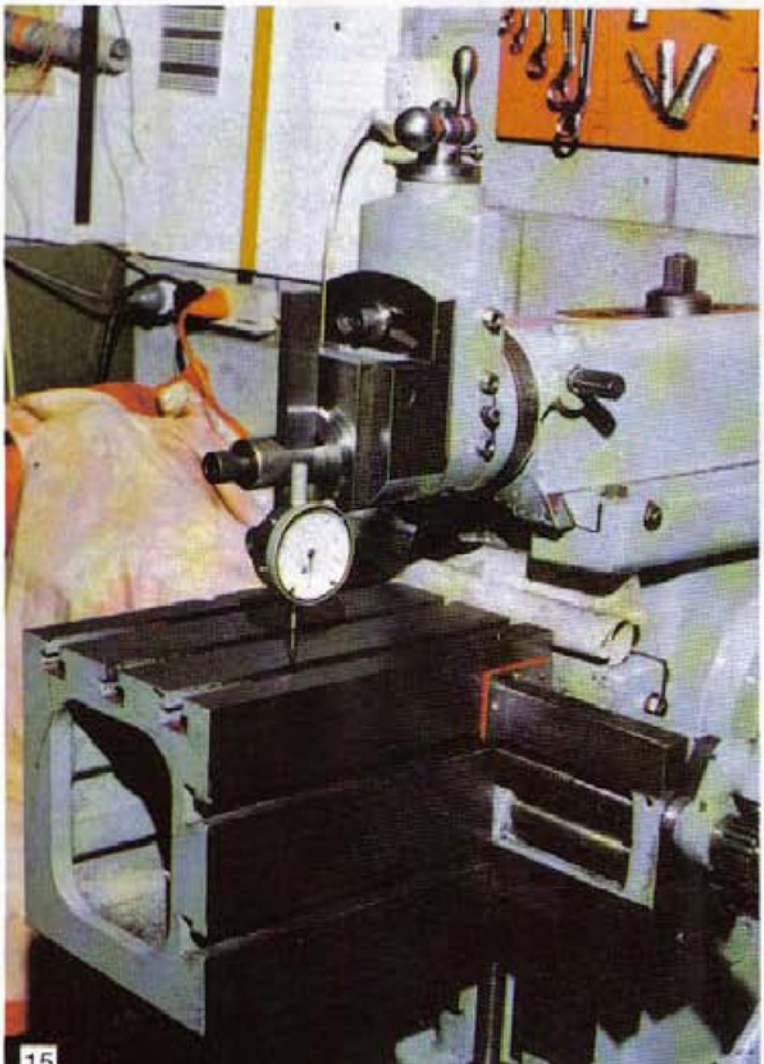

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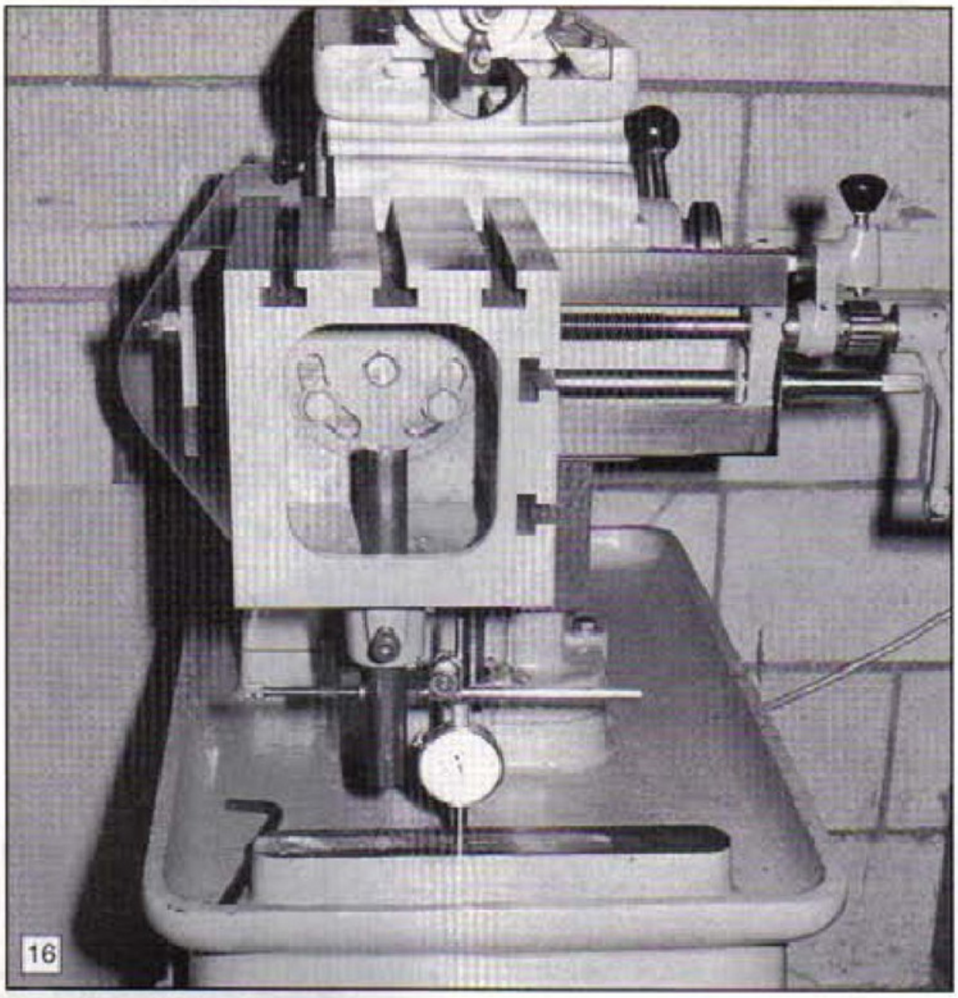
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The stroke of the ram depends on the distance of the crank pin from the centre of the bull wheel. The upper end of the stroke arm is attached to the ram by a stud and nut adjustable in position along a longitudinal slot (visible in **Fig.15**). This allows one to adjust the position of the beginning of the stroke of the ram.

The stroke mechanism

The stroke mechanism geometry is shown in **Fig.12.** The further from the centre the crankpin is fixed the longer the stroke, so that for example with the pin a "a", the stroke length is "A - A" and with the pin at "b" it is "B - B". Note that the cutting stroke takes place over the arc a-c-a or b-c-b while the return stroke takes place over a-r-a and b-r-b respectively. Since the return arc is shorter than the cutting arc, the return stroke is faster and non-cutting time is reduced also more force is available for the cutting stroke and less for the return. Notice also that the return arc gets shorter and quicker as the stroke length increases, while the tool has to traverse a greater distance in the same time so that cutting speed rises, with corresponding increases in shock loading and vibration at the reversal of ram motion and at the onset of cutting.

The right hand end of the bull wheel shaft carries a circular crank which has a tee slot machined across a diameter **(Fig.13).** The tee bolt carries a bearing bush which can be adjusted in position along the diameter thus varying the stroke of the crank. An adjustable link connects this to a lever which is free to swing on the cross feed shaft **(Fig.14).** Attached to the lever is a spring loaded pawl which engages with a ratchet wheel keyed to the feed shaft. As the bull wheel rotates the ram is driven forwards and the feed crank rotates, the feed link reciprocates, the lever swings and the pawl gathers between 1-5 teeth, depending on the length of stroke set on the circular crank. As the ram returns on the non-cutting stroke the pawl engages, rotates the feed shaft and feeds the table across. The pawl can be rotated through 180 deg. to reverse the direction of feed and it also has a neutral position so that the table can be fed by hand with a crank which engages the squared end of the shaft. Not so obviously, if the feed direction is reversed, the crankpin must be moved to the opposite radius of the tee slot as the table would otherwise feed on the cutting stroke. To put it another way, you should always hear the click of the pawl gathering on the forward or cutting stroke of the ram.

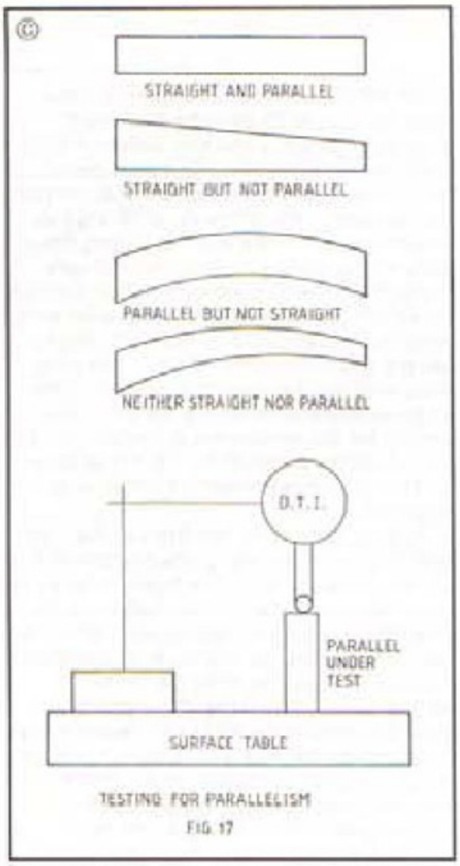
Before rushing into using your newly acquired shaper, you should of course give it a good clean up, dismantling it if necessary and replacing worn parts, followed by oiling the oiling points and slides. All the slides except the ram should be adjusted to move rather stiffly as the cutting load is necessarily intermittent and clearances should be kept to a minimum. The ram of course should be adjusted to slide sweetly without any trace of play.

Checkings its accuracy

Measure the length of the table and set the stroke of the ram to be 30 to 40mm less than this. To do this, you pull the machine around by hand until the slot in the bull wheel is straight up and down on the forward stroke. You then loosen the nut and slide the drive block up or down until the index engraved on it is opposite the desired length of stroke on the scale attached to the stroke arm. Tighten it very firmly or unpleasant things may happen when the load comes on. Again by hand, wind the ram to its extreme backward position and with a dial test indicator (DTI) in the tool post, loosen the nut on top of the ram and adjust the ram position so that the plunger of the DTI rests as far back as possible on the table without fouling the body of the shaper. Tighten the nut very firmly. With the peg leg up you can then set the DTI to read zero with the tool slide and wind the ram forward by hand. Do this for several positions of the table on the cross slide until you have built up an idea of the alignment of the table **(Fig.15).** You are aiming for the movement of the tool to be parallel to the plane of the top of the table and for the cross movement of the table to be parallel to its top.

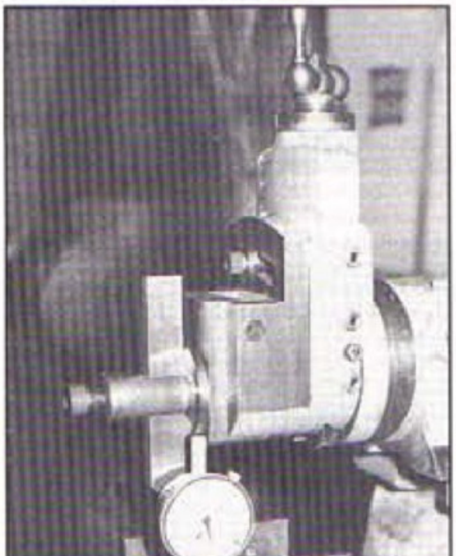
If, as is most likely, the front of the table seems to be drooping, check that the slides are not loose by lifting the front of the table while observing the DTI and adjusting the gibs and retaining plates as necessary. If it seems to be sloping from side to side then you will have to check the gib of the vertical slide. I found that the top of my table drooped to the front and sloped to the right and stayed that way despite having all the gib adjustment screws tight. There seemed to be nothing for it so I took a finishing skim over the top of the table, only to find on retesting that it was better, but still out of truth in a different direction. I wondered about foreign particles trapped between the slide surfaces and it took me several dismantlings before I discovered that none of the gib adjustment screws had been tapped right through, so that when I thought the screws were hard up against the gib strips some of them were simply jammed in their holes. The machine is probably at least forty years old and during that time presumably none had been offended enough by its performance to wish to track down its cause. Once the holes were tapped through, the slides readjusted and a further skim taken off the top of the table, all was well on test.

As the tool nears the end of its stroke, the table will tend to flex downwards and the supporting peg leg (or slide on larger machines) is there to reduce this tendency. The surface on the base on which the tip of the leg slides is perhaps the most prone to wear as swarf gets ground in or one forgets to loosen the locking screw before winding the table down with a bang as the leg hammers home. Obviously, if this surface is not parallel to the cross movement of the table it may fail to support it in some positions or force it upwards in others, with the faults of the supporting surface reproduced on the work. **Fig.16** shows the test set up. The surface was visibly bruised on mine and sloping downwards to the left. Before I got too enthusiastic with file and scraper, I recalled that the combined weight of the machine and its base had been too much for the engine lifter I had hired to get it off the trailer so I had separated them in order to install the machine (the lifter, capacity 300kg, could only just manage the base and machine individually). A tiny particle of grit between the mating surfaces on reassembly could have been enough to throw things out of alignment and indeed, on cleaning these surfaces, much of the general trend down to the left disappeared. I removed the bruises and brought the surface into the correct plane with a scraper before screwing on a steel wearing strip which



can be replaced or refurbished as necessary.

While much work can be attached directly to the table and is perhaps even best done this way, smaller parts are most conveniently held in a machine vice bolted to the table. In my view, the vice is often a source of problems when using both shaper and milling machine as errors of parallelism tend to accumulate. Here, as in other areas of life, you tend to get what you pay for and it is worth finding out exactly what you have paid for before scrapping too many parts. When holding a workpiece in a machine vice it is tapped down onto parallels resting on the top of the vice ways (running face). Amateurs' parallels are often anything but straight and parallel, so check this first, not with a micrometer which will check only parallelism, but with a DTI and surface plate if you have one **(Fig.17)**. So-called parallels can be straight and parallel, not straight but parallel, straight but not parallel and neither straight nor parallel. If you know that the machine table is flat, you can use this instead of a surface plate. Then set up the vice on the machine table and check the running face for parallelism to the top of the table **(Fig.18)** using a combination of ram and cross slide movement. I should not have to point out that this should not be done under power, but all the text books do, so I shall follow suit! Repeat the check with the vice rotated through 90 and 180 deg. on its base and if it is parallel to within 0.02mm, you have a first class vice and shaper combination. The vice which came with the shaper alas was not and I was again faced with puzzling errors since when the vice was checked on a surface plate with a DTI, the top and bottom of the base, bottom of vice and running ways and base and vice together were all reasonably parallel after I had skimmed the base of the vice **(Fig.19)**; but when it was bolted to the shaper table it developed seemingly haphazard errors. I eventually discovered that tightening the nuts that attach the vice to its base distorts the base and it is impossible to rely on the combination being parallel to better than about 0.04mm. It is almost certainly of Taiwanese origin, but before Europeans begin to sneer at East Asian machinery let me say that I am lucky enough to own another machine vice of Taiwanese origin with a finish and precision beyond reproach. However, it cost me the royalties from quite a long *M.E.W.* article and weighs 19kg as opposed to 11kg for the cheaper vice.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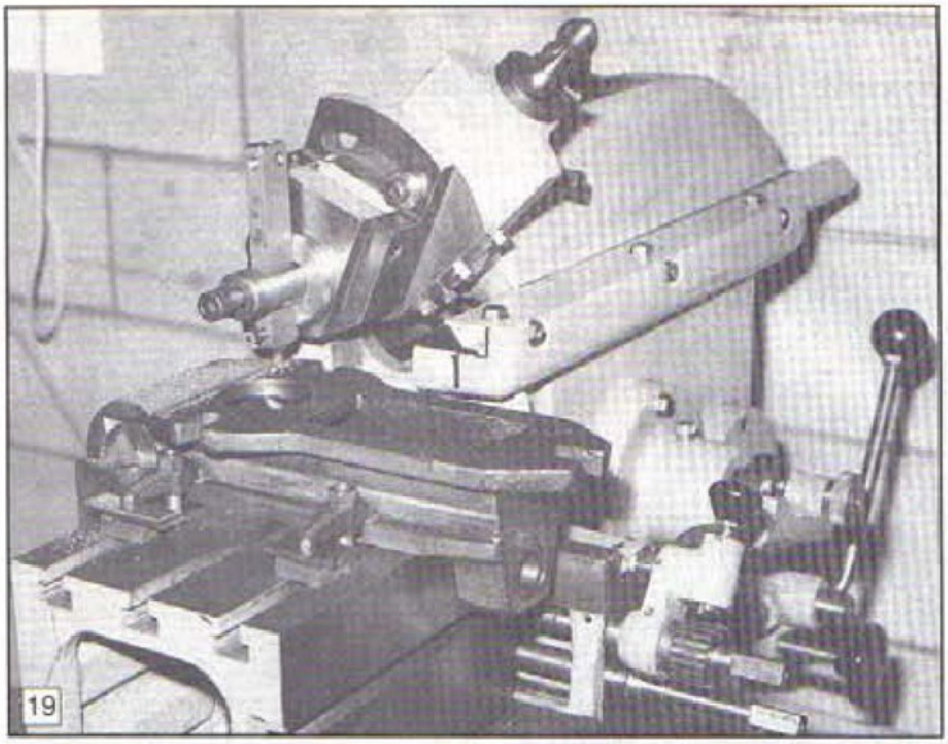
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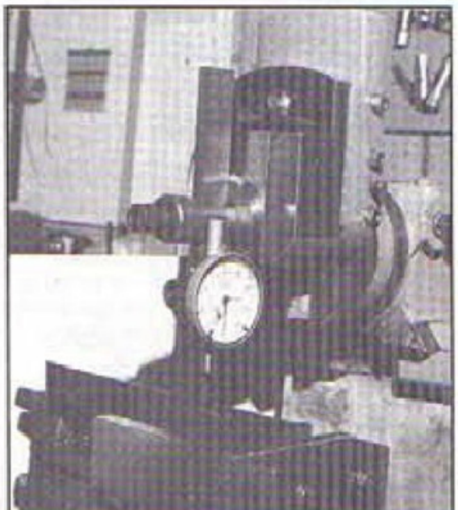
To check that the fixed jaw of the vice is at right angles to the movement of the table, hold the body of a square in the vice and run a DTI along the blade by winding the cross slide along **(Fig.20)**. This is easier to do than holding a square against the running face and jaw since even an 11kg vice is not easy for most of us to hold up to the light. Note that neither of these tests, strictly speaking, check that the fixed jaw is square to the base unless the table is in perfect alignment. To do that you need quite a large surface plate and DTI using the method shown in **Fig.17.**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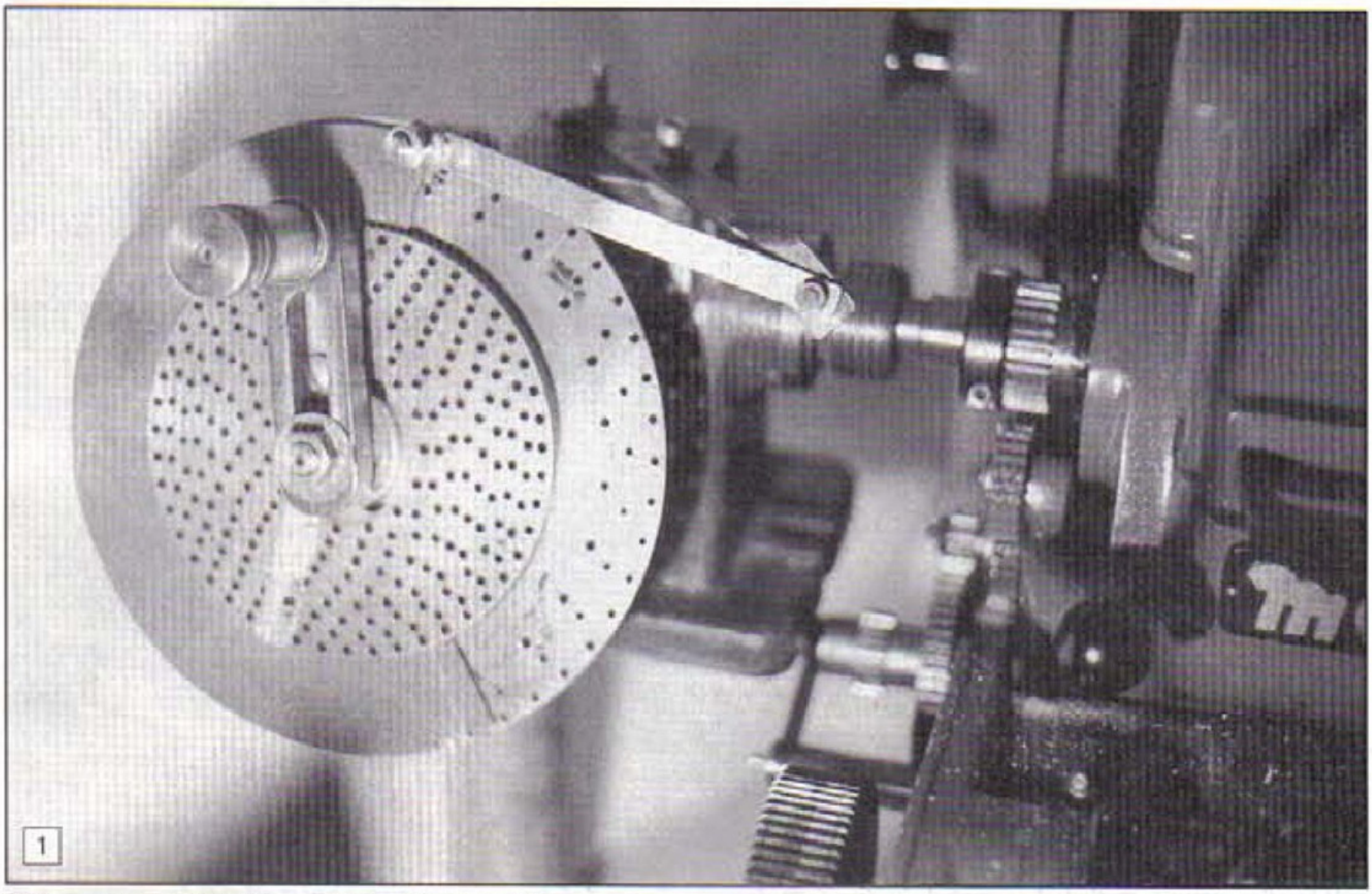
You are now almost ready to start on those tee nuts you have never quite got around to or to make that pair of vee blocks you could never bring yourself to buy or to make yourself; a vertical slide for the lathe, or any number of devices that need slides and plane surfaces. Why not be patient a little longer and fit a locking screw to the tool and vertical slides **(Fig.8a)**, a vinyl apron to keep swarf off the vertical slide **(Fig.16)** or felt wipers to the cross slide **(Fig.15)**? It is also worthwhile bolting the machine to the floor if possible as it will otherwise tend to walk backwards away from you. If you wish to machine an angular surface that is wider than the travel of the tool slide, you will have to rotate the table on its horizontal axis. It is useful when bolting the shaper down to set it with the table level using a sensitive level as this can be very helpful when resetting the table after machining such surfaces.



1: *The set-up for 113 divisions using two dividing plates.*

DIVIDING FUNNY NUMBERS

Geoff Gray had the need for dividing of 113 and 73 divisions, which he calls funny numbers, I think I would agree. This requirement could involve a lot of trial and error mathematics to arrive at a suitable method, but he indicates a source of valuable information which will avoid this for all numbers up to 250. The method requires two differing rings of holes which are used simultaneously. In Geoff's case this meant two separate dividing plates. In this article he describes how he went about this.

I recently needed to make a 113-tooth wheel for my latest clock project. My dividing head is a standard commercial job complete with tailstock. It is equipped with two cast iron index plates 5in. dia. each with nine circles ranging from fifteen to forty nine holes. This I believe is the Brown and Sharp system. It covers all counts up to fifty and a fair number up to 360, but not 113.

To index 113, two index plates have to be used and this is where my maths fail me. A visit to the local reference library produced *Machinery's Handbook.* Page 1485 of the volume I consulted *(page 1756 of the latest edition, No. 24)* gives a description of indexing followed by a table of movements for indexing all counts up to 250.

The 113 count calls for three full turns plus 26 holes on a 47 index circle, minus 18 holes on a 49 index circle.

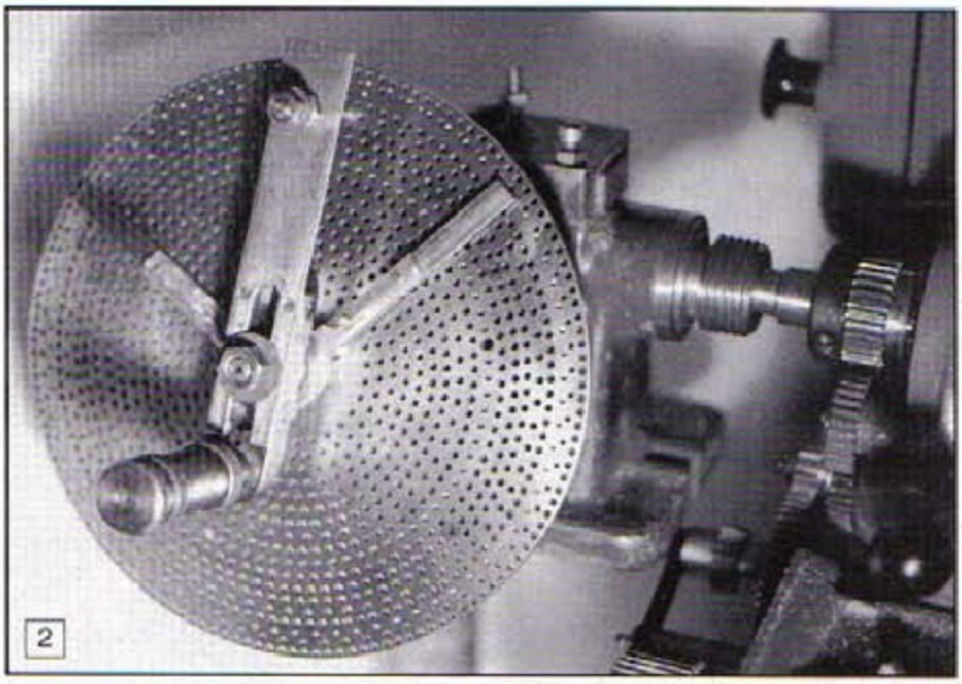
I made an index plate from ¼in. mild steel plate 7in. dia., i.e. 2in. dia. more than the 5in. dia. cast iron index plate. I indexed and drilled a 49-hole circle near the outer edge, then bored it to clear the dividing head boss and fixed it to the back of the cast iron index plate containing the 47-hole circle. It was fastened with 3 x 2BA screws, care being taken not to break into any index holes in the existing cast iron plate.

The pair of plates were now put onto the dividing head and left free to rotate. The quadrant sector fingers and spring retaining clip were replaced followed by the index pin arm set to the 47-hole circle. The quadrant sector fingers were then set to span 26 holes on the 47-hole circle. Rotating the two plates now turns the dividing head mandrel through the forty to one worm reduction.

An index pin arm was made from ½ x ¼in. mild steel and bolted to the top of the dividing head, then set to locate in the 49-hole circle in the 7in. dia. index plate. A disc of hardboard was cut to 7in. dia. and its centre cut out to a good fit over the 5in. dia. index plate. The hardboard was then cut to uncover 18 holes of the 49 circle and this acts as quadrant sector fingers. All these details will be seen on **photograph 1.**

As my 9in. dia. direct index plate was full a new one was bandsawn from ¼in. sheet and finished on the lathe faceplate.

The dividing head mandrel is bored No. 2 M.T. and it is attached to the tail-end of the lathe mandrel with a No.2 M.T. arbor with a parallel portion about 3in. long to fit in the lathe mandrel. This end is bored taper and split and provided with a taper plug on the end of a long ¼in. stud. This stud extends out through the dividing head



2: ***When used with larger diameter plates the quadrant fingers and the index pin arm are fitted with extensions.***

mandrel and a nut and washer is used to tighten the whole assembly. The dividing head base is bolted to the bench using a suitable length of 2in. dia. alloy tube as a distance piece, see **photograph 2.**

The drilling spindle is now set up on the vertical slide mounted on the lathe crosslide. The index plate blank is drilled with a 1/16in. dia. centre drill held in a collet with the minimum amount protruding, **photograph 3.**

A degree of concentration is required to successfully index the 113 hole. An order of performing the index sequence should be decided upon and rigidly adhered to: my sequence was: turn quadrant sector fingers clockwise up to the index pin on the 47-hole circle, rotate index pin clockwise three complete turns plus the 26 holes spanned by the sector fingers, then turn the hardboard disc clockwise to the 49-hole circle index pin and then turn index plates and hardboard disc anti-clockwise over the 18 holes spanned by the disc. Repeat 112 times. After completing a full circle of holes I am always pleasantly surprised to find I have the desired number.

I also needed a 146 count and with my dividing head it would have to be done using two index plates. The movements being 2 turns plus 3 holes on a 32 circle minus 8 holes on a 49 circle. It can also be done with a 73 circle moving 20 holes each time. It so happened I had a 73 circle on my 7in. plate, which was made for a previous clock.

This plate was fitted to the dividing head and extensions were made for the quadrant sector fingers and the index pin arm to cover the full diameter of the plate. These details can be seen on **photo 2.**

After indexing all the required counts the new index plate is finish-drilled on the drilling machine with a 5/64in. drill. The finished plate is shown set up on the lathe mandrel on **photograph 4.** You may spot the six holes in isolation where I inadvertently started a 75-hole circle on the same P.C.D. as the 2BA holes used for bolting the plate to the lathe faceplate.

Photograph 5 shows the drilling spindle mounting for the motor. It can be bolted to the crosslide vertically or horizontally. If the spindle runs the wrong way the belt can be crossed and the tension quickly reset. It will be seen that the only modification to my dividing head was the drilling of 3 × 2BA holes in the back of one of the index plates. Plus the addition of a mild steel index plate and index arm and pin. Also that larger index plates can be fitted with only extensions to quadrant sector fingers and index pin arm being required. Now you can get on and do those funny numbers.

Postscript by the editor

For the mathematically inquisitive reader. Total number of degrees movement of the output spindle for 113 divisions using the parameters in the article.

$$OP = 113\times\left(\frac{360\times3}{40} + \left(\frac{360}{40}\times\frac{26}{47}\right) - \left(\frac{360}{40}\times\frac{18}{49}\right)\right)$$ degrees

$$OP = 113\times\left(\frac{360}{40}\left(3+\frac{26}{47}-\frac{18}{49}\right)\right)\text{degrees}$$

$$OP = \frac{113\times360}{40}\left(3+\frac{26}{47}-\frac{18}{49}\right)\text{ degrees}$$

output in revolutions =

$$REV = \frac{113\times360}{360\quad 40}\left(3+\frac{26}{47}-\frac{18}{49}\right)\text{ revolutions}$$

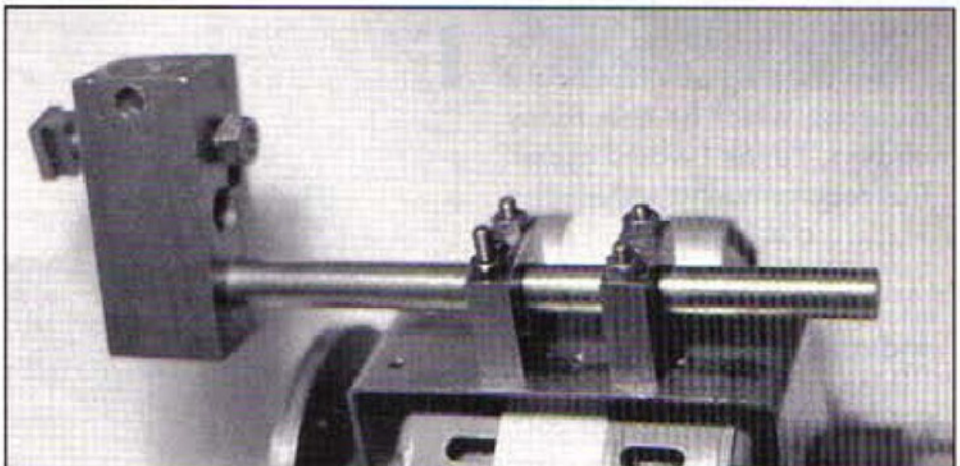
REV = 9.000010855

Therefore the first 112 divisions will be 0.000000096 of a revolution oversize, $\left(\frac{0.000010855}{113}\right)$ whilst the final division will be 0.000010759 of a revolution undersize. As one division equals 0.008849557 of a revolution the error in the final division is 0.122%.

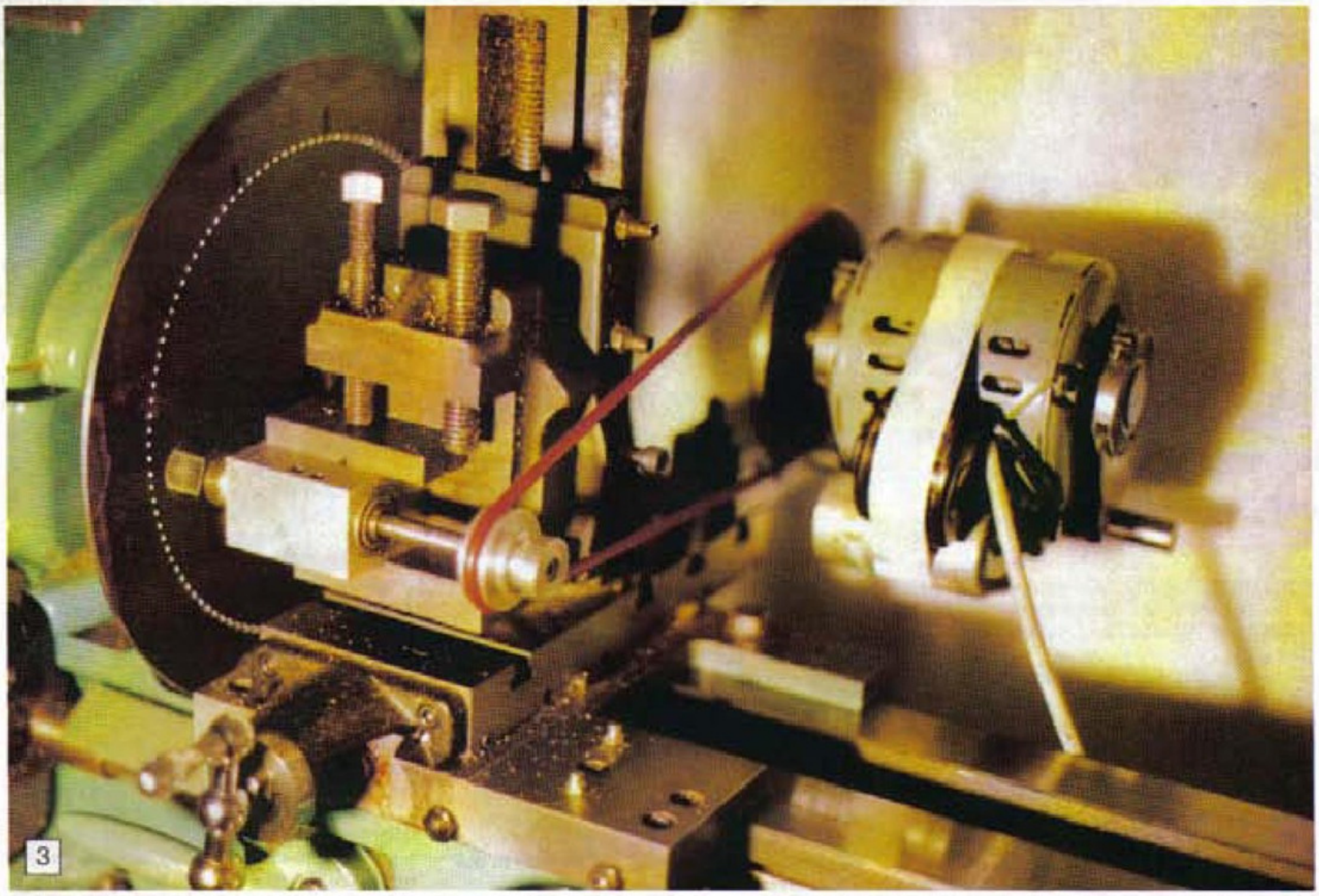
QUICK TIP

Whatever type of plug gauge you are making, use a reduced diameter lead to give a warning when the boring is approaching the final diameter. If the topslide is set over 6 deg. a 1 in 10 taper will be turned on the end of the gauge and if this is made 0.1in. long the entry diameter will be 20 thou. below the desired bore giving plenty of warning and the distance the taper enters will give an idea of how much more metal has to be removed.

Hugh Mothersole



5: ***The drilling spindle motor mounting arrangement.***



3: Drilling spindle set up on the lathe cross slide for the initial marking of a new dividing ring of holes. The drilling spindle shown is a temporary set-up and was used with due regard to operator safety.

4: The simple set-up when a dividing plate is mounted directly to the changewheel end of the lathe mandrel.

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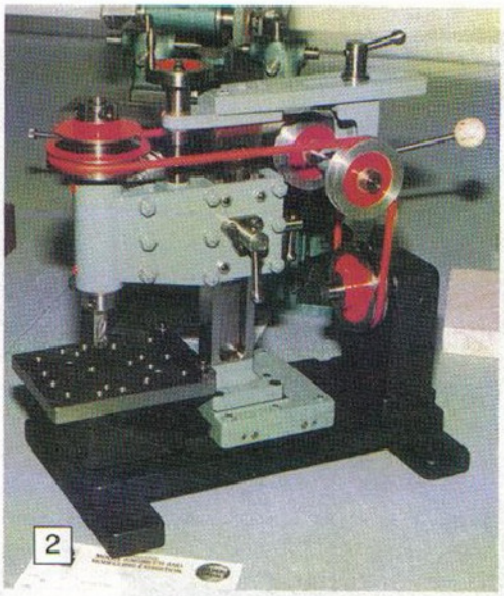

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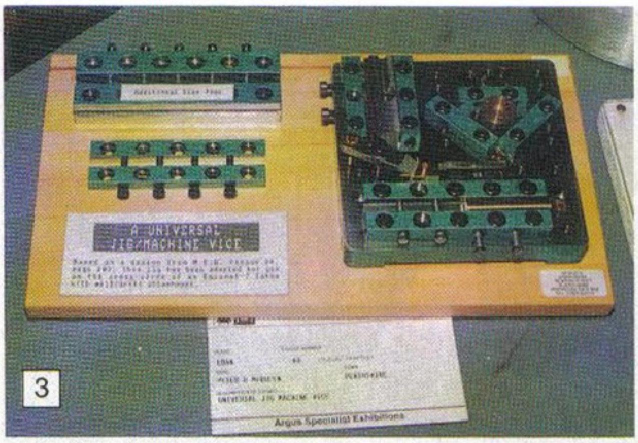
INTERN… 6… MODEL E… *and Modellin…*

1: *Stent Tool and Cutter Grinder made by Mr. Ernest Bartlett of Farningham.*
2: *Vertical Milling Attachment for use on a Myford ML10, made by Leonard Walker of Torquay.*
3: *A very nice example of something made to a* M.E.W. *design. This Universal Jig/Machine Vice made by Peter McQueen of Perthshire, is based on the design published in issue 16 page 28.*
4: *Three items by Bob Loader of Harlow, who provides many articles for* M.E.W. *The four jaw chuck on the right is his prototype for the article in issue 11 page 32. The small vice in the centre is the subject of an article planned for the future. That on the left featured in the very first issue of* M.E.W.
5: *Another author's prototype, this one for the fabricated angle plate featured in issue 8 page 28 by H. Maurice Turnbull of Killamarsh.*
6: *The story behind this lathe is quite interesting. It was made by Anthony Tipple of West Ayton for his son and grandson to enable them to extend their model making activities, and lead them to a more professional lathe later. He has named it the* Simplex Student. *He states that it is this size because that was the size of the off cuts, some remaining pieces seen in the photograph.*

The 63rd Model Engineer and Modelling Exhibition was held at Olympia, London at the start of the year. In addition to the very wide range of engineering and other models, made to a very high standard, were, as always, a number of items of workshop equipment. My impression was, although I have not attempted to verify this, that the number of workshop items on display was a little greater than in recent years.

Items exhibited are divided into two groups. The Competition class for which awards and medals are given, and if of sufficiently high standard of originality or workmanship, a cup is gained by the overall winner. The Loan section section is for other items that exhibitors do not want to enter competitively, or perhaps have won previously and are no longer eligible for the competition class.

The photographs show a major portion of items exhibited, and it is interesting to note that in some cases they have been featured in *Model Engineers' Workshop.* This has been either as the author's original prototype or alternatively made by another from the published designs. Why not make up your mind to have something there yourself next year? Now is the time to start making plans!!



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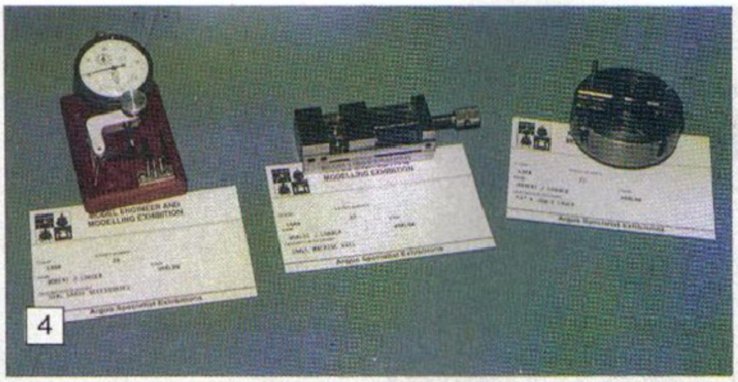

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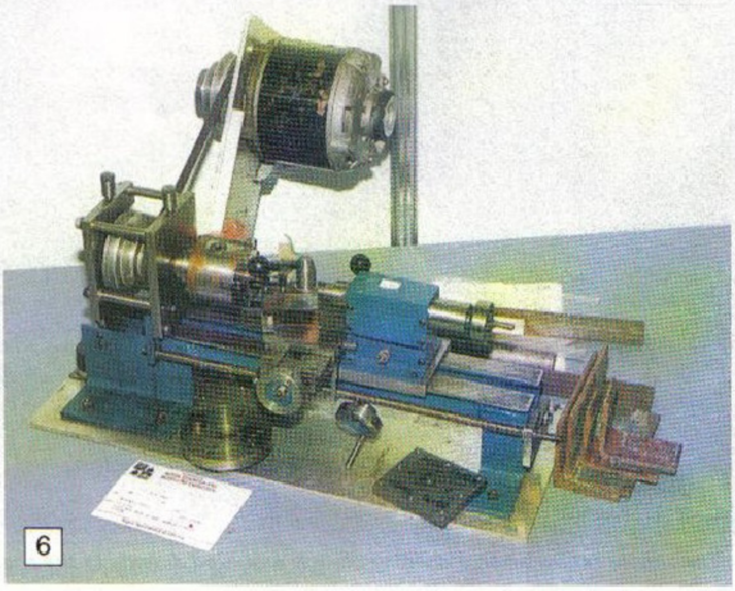

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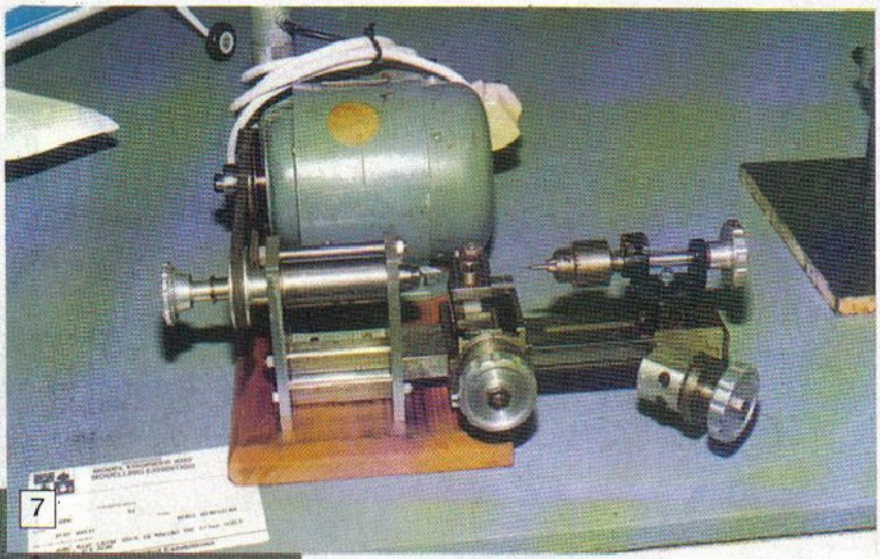
Should any of the exhibitors of the items seen in the photographs like to have a copy of the photo of their exhibit, please send me a S.A.E. and I will arrange for them to be sent once they are returned from the printer.

Front Cover: The very nice set of bending rolls, seen on the front cover, were exhibited by Colin Brooks of Newbury.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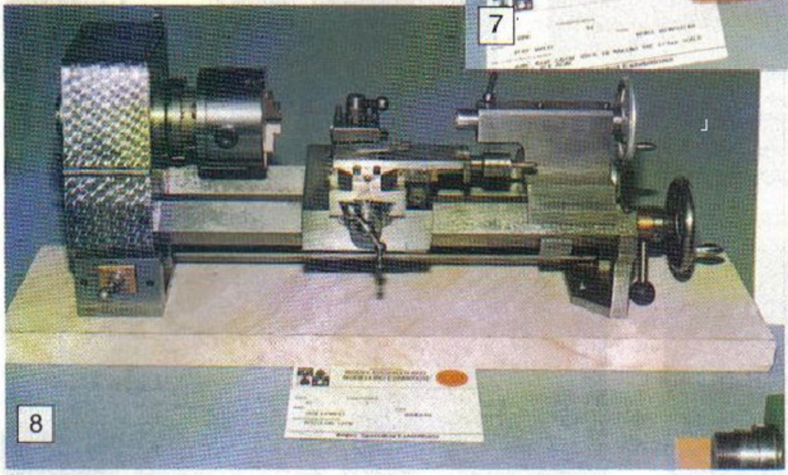
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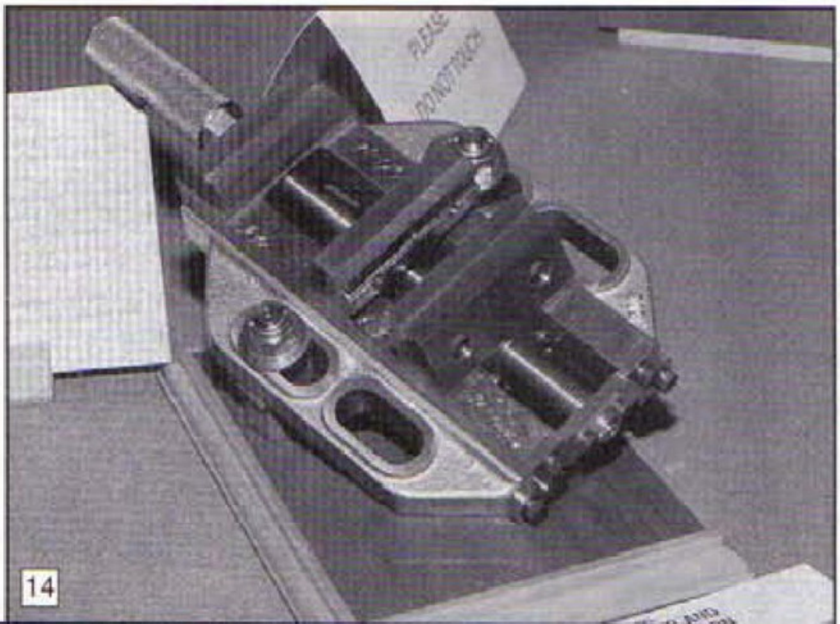
7: Another small lathe, this one by Bert White of Hemel Hempstead. This was made with the purpose of assisting in making some of the parts for a ⅓rd scale model Rex Acme motor cycle, which was recently featured in Model Engineer.
8: A very nice modelling lathe made by John Lenaers of Hounslow.
9: Some very nice and, more important, useful accessories were on display, these two by Terence Rodway of Morden. Anyone who has tried to free the belts from the lathe spindle, so as to check the balance of a faceplate set up, will appreciate this free standing, free running spindle, seen on the left, on which the exercise can be completed more easily.
10: Multi purpose drilling fixture by Peter Clark of Southwold.
11: Self powered auxiliary mandrel, with accessories by David Dew of King's Lynn.
12: Versatile dividing head exhibited by Graham Stothard of Stockwell.



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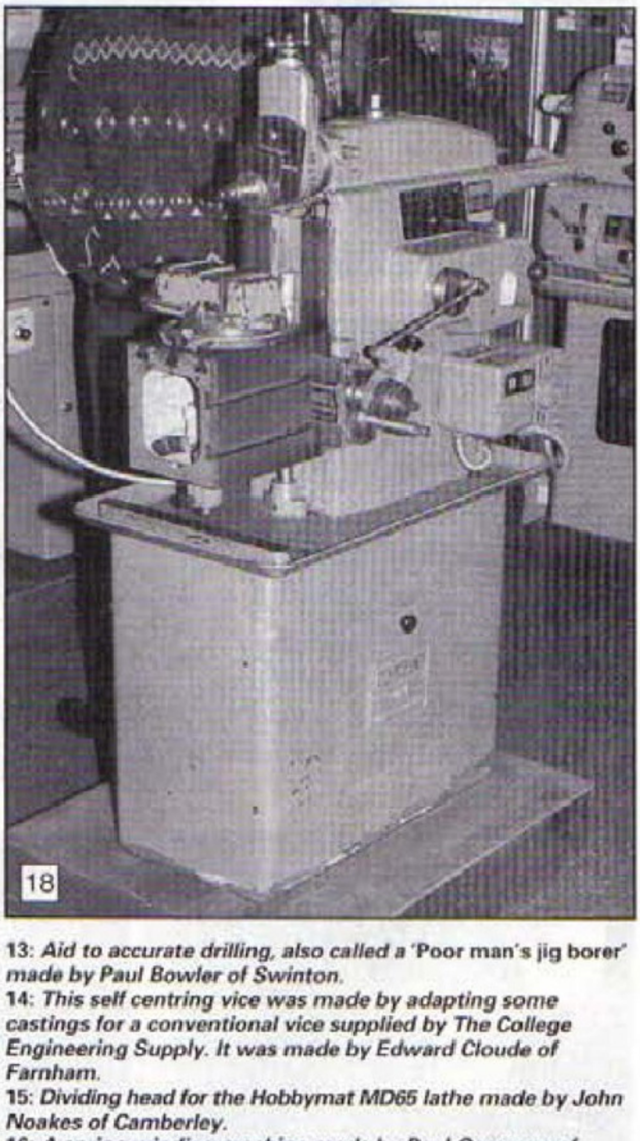

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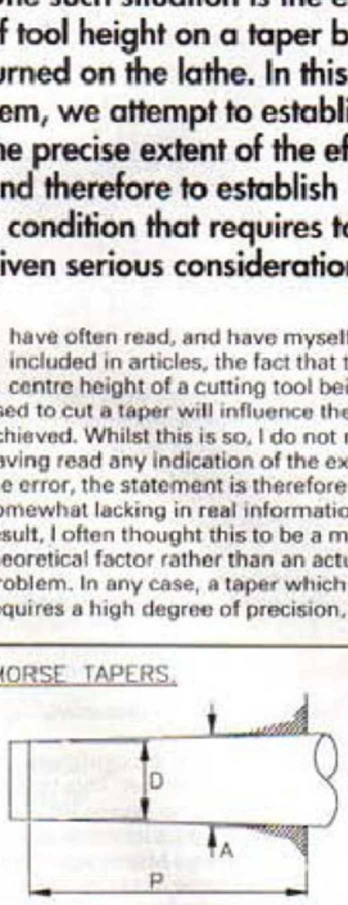
13: *Aid to accurate drilling, also called a 'Poor man's jig borer' made by Paul Bowler of Swinton.*
14: *This self centring vice was made by adapting some castings for a conventional vice supplied by The College Engineering Supply. It was made by Edward Cloude of Farnham.*
15: *Dividing head for the Hobbymat MD65 lathe made by John Noakes of Camberley.*
16: *A spring winding machine made by Paul Gammon of Epsom.*
17: *In the Junior section, Richard Tilbrook of Leys School, Cambridge, made this very nice work centre for plastic kit modelling.*
18: *Trade stands followed their usual pattern, but one rarely seen visitor to the exhibition was this shaping machine. It would appear that interest in owning one of these in the home workshop is on the increase. This was seen on the stand of Intercity Machine Tools (High Wycombe) Ltd.*

THE MATHEMATICS OF TAPER TURNING

Comments are often made in articles and lectures etc. that changes in one condition will have adverse effect on another; frequently without any attempt to quantify the change, either precisely or approximately. One such situation is the effect of tool height on a taper being turned on the lathe. In this brief item, we attempt to establish the precise extent of the effect, and therefore to establish if it is a condition that requires to be given serious consideration.

I have often read, and have myself included in articles, the fact that the centre height of a cutting tool being used to cut a taper will influence the taper achieved. Whilst this is so, I do not recollect having read any indication of the extent of the error, the statement is therefore somewhat lacking in real information. As a result, I often thought this to be a more theoretical factor rather than an actual problem. In any case, a taper which requires a high degree of precision, as far as the angle is concerned, such as a Morse taper, will be set by trial and error. The result being that any potential error due to an incorrectly set tool, will be compensated by a minute error in the angle set, either on the top slide or the taper turning attachment.

MORSE TAPERS.



TAPER NO.	PLUG DIA. D	GAUGE DEPTH P	END OF SOCKET DIA. A	TAPER ON DIA.
	IN.	IN.	IN.	IN./FT.
0	0.252	2	0.356	0.62460
1	0.369	2 1/8	0.475	0.59858
2	0.572	2 9/16	0.700	0.59941
3	0.778	3 3/16	0.938	0.60235
4	1.020	4 1/16	1.231	0.62326
5	1.475	5 3/16	1.748	0.63151
6	2.116	7 1/4	2.494	0.62565
7	2.750	10	3.270	0.62400

NOTES.
1. THE DIMENSIONS QUOTED ARE FOR THE STANDARD PLUG GAUGE.
2. THE SHANK OR SOCKET CAN BE MADE ANY LENGTH, IN WHICH CASE, DIMENSION A IS MAINTAINED AND THE DIAMETER AT THE LARGER END ALLOWED TO CHANGE.
3. THE BASE OF THE SOCKET MUST BE DEEP ENOUGH TO ACCEPT SHANKS WITH INTEGRAL TANG, AND PROVISION FOR EXTRACTION OF SHANK FROM SOCKET.

It was however, as a result of a query from a reader who was producing tapers with a curve along their length, that I recalled this was also an effect of a tool being set off centre height. The reader was producing tapers with a curve when using the attachment described in issue 9 of *M.E.W.* (*Have other readers had successes or failures with this unit – Ed.?*)

On this basis, it is obviously more important to have the tool at the correct height to achieve a constant taper, than it is to achieve the required overall taper. There is one point to be taken note of, that is, if a number of tapers are being turned and the tool becomes blunt, then if a replacement or resharpened tool is not set back at the same height, a change of taper will result. Similarly, if you have a taper attachment and have dowelled it, so that it can be set instantly for subsequent Morse tapers, then precise setting of the tool height will be essential.

Quantifying the errors

It was with these thoughts in mind that I contemplated the possibility of quantifying the errors mathematically. My first thoughts were that this should not be too difficult, but would involve the use of a lot of individual trigonometrical calculations to arrive at the final answer. I soon realised that this was not so, and that the answers could easily be arrived at by the repeated use of Pythagoras's theorem. For those for whom this is a vague recollection from school days, the theory states that, for a right angle triangle, the sum of the squares of the two shorter sides is equal to the square of the longer.

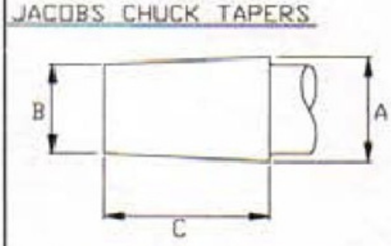
The results of the calculations, which are illustrated, are based on the principle that the diameters at the ends are as required, the top slide or taper attachment having been set to accommodate the error, and it is the error along its length that is being considered.

The calculations

I do not consider it necessary to include in the article the actual calculations, but only the findings. However a brief explanation of how the findings were arrived at would seem appropriate.

With a little thought, maybe as the explanation progresses, it should be obvious that the error will be independent of angle or length, being only affected by the magnitude of the difference between one end and the other, also the diameters themselves. Because of this, no further mention will be made of length or angle and only of diameters.

JACOBS CHUCK TAPERS



NO.	A	B	C	TAPER ON DIA.
	IN.	IN.	IN.	IN./FT.
0	0.2500	0.22844	0.43750	0.59145
1	0.3840	0.33341	0.65625	0.92500
2	0.5590	0.48764	0.87500	0.97861
2a	0.5488	0.48764	0.75000	0.97861
3	0.8110	0.74610	1.21875	0.63898
4	1.1240	1.03720	1.65630	0 62886
5	1.4130	1.31610	1.87500	0.62010
6	0.6760	0.62410	1.00000	0.62292
33	0.6240	0.56050	1.00000	0.76194

TAPER PINS

TAPER PINS ARE MADE WITH A TAPER OF 1 IN 48, THAT IS 1/4 IN. IN 1 FOOT.

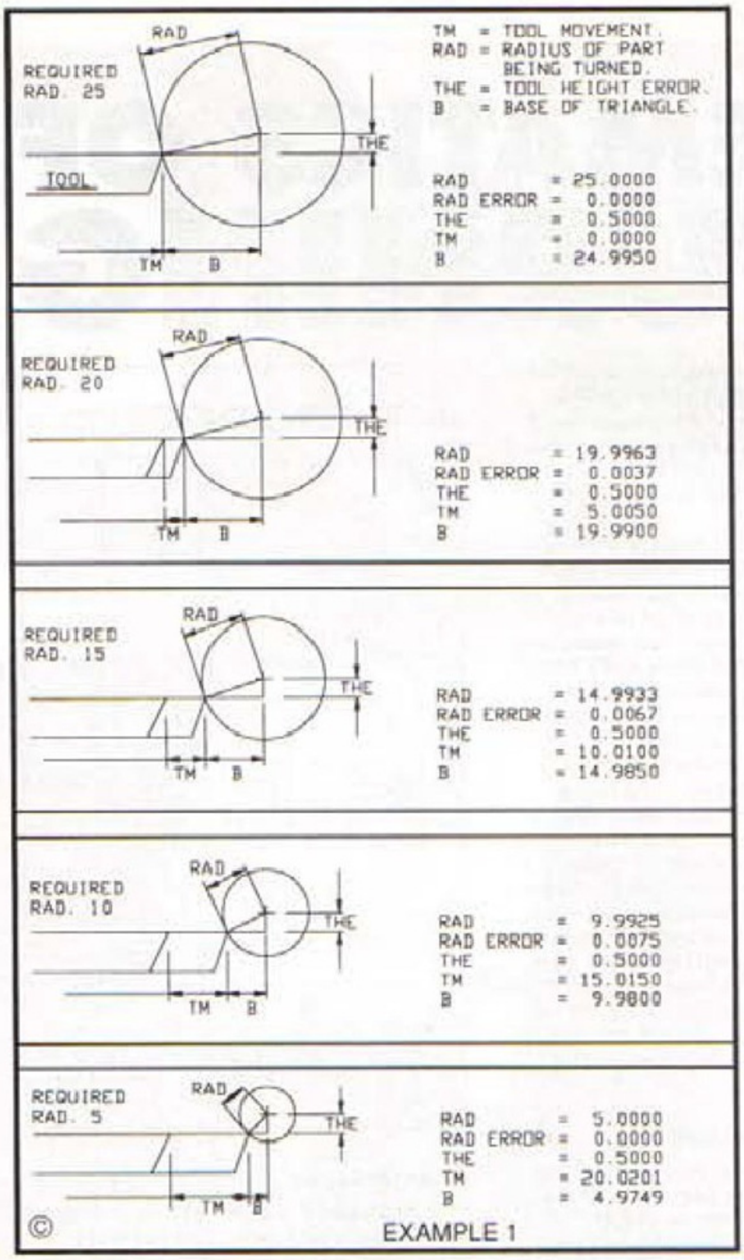
A larger taper

In **example 1**, a taper is being produced from 50mm diameter at the large end to 10mm diameter at the small end, and using a tool which is set 0.5mm low **(THE).** Taking first the larger end, and knowing both the radius and the error in the height of the tool, the displacement of the tool **(B)** from the vertical centre can be calculated using Pythagoras's theorem, the result being 24.9950mm. In the same manner the displacement can be calculated for the smaller end, resulting in an answer of 4.9749mm.

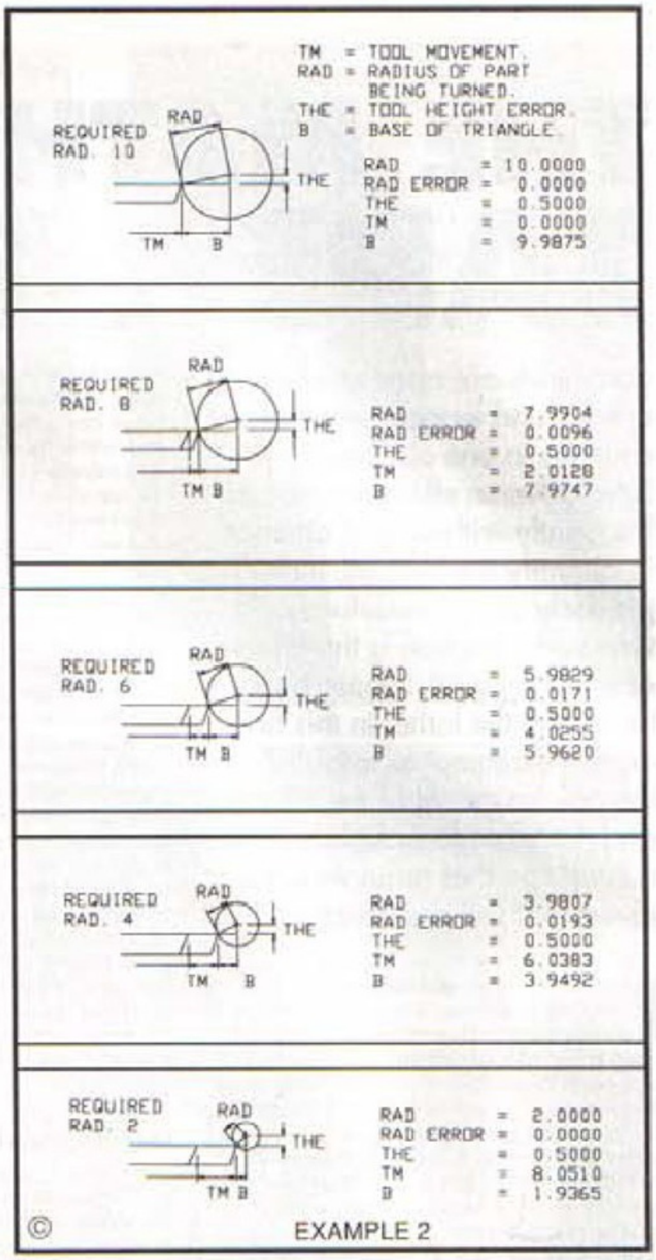
As the movement of the tool between these two extremes (TM = 20.0201mm) will be linear, the displacement at any other point can be arrived at by proportions. That is to say, at the mid point along the length of the taper the displacement will be exactly half way between that at the two ends. In the example this gives a value of 14.9850mm as a result of tool movement of 10.010mm. Displacement at any other point can be calculated in the same manner.

Now with displacement known, also the error in tool height, the radius of the taper at that point can be calculated, again using Pythagoras's theorem. The example shows this to be 14.9933mm instead of the required value of 15mm. The error on radius is 0.0067mm and therefore on diameter, 0.0134mm. A little over ½ thou. for those who like Imperial measurements.

Closer inspection of the example shows surprisingly that the maximum error does not occur in the mid position, increasing to 0.0075 at a position one quarter along the



EXAMPLE 1



EXAMPLE 2

length of the taper. The actual position and magnitude of the maximum error was not pursued mathematically, as this would involve some complex calculations, involving no doubt the use of calculus, I must confess to being a bit rusty in this area. *(Has any reader the time and ability to provide these calculations, I may not publish them in M.E.W. but would make them available to any reader who requested them? Ed.)*

A smaller taper

A second set of calculations **(example 2)** was done in exactly the same way, this time for a taper from 20mm diameter at the large end to 4mm diameter at the small end, still a ratio of 5:1. In this case the maximum calculated error is 0.0193mm on radius, 0.0386mmn on diameter, almost three times that in the previous example. From this it can be seen, not surprisingly, the error is larger for tapers of smaller diameters.

Whilst not the intention of the original calculations, it soon became apparent that the error in taper over the full length due to incorrect tool height could easily be deduced from the calculations already made. Returning therefore to the original example, it can be seen that the tool movement **TM** between the position for the 25mm radius and the 5mm radius is 20.0200mm, rather than the 20mm that it would be if the tool was exactly on centre height. From this fact it can be seen that should the tool be replaced with one at centre height, without resetting the top slide or taper attachment, the taper would be 0.0400mm small on diameter at the smaller end, around 0.0015 inch.

If conversely a taper was set with a tool at centre height then replaced with one 0.5mm low then the small diameter would be 0.0400mm oversize. Similar inspection of the results in the second example again show the error is larger with smaller diameter tapers, in this instance an error on diameter of 0.1020mm at the smaller end, around 0.004 inch.

Conclusions

These examples show that the error as a result of incorrect tool height, is greater on overall taper than it is on the curvature along its length. However, as was said earlier, the overall taper will most likely be set by trial and error and, as a result, any error in tool height will be cancelled out by an error in the angle to which the top slide or taper attachment is set. Providing there is no change in tool height if tools are changed or removed for resharpening, then this is of little consequence.

There is, therefore only the curvature along its length left to consider. This being smaller perhaps there is no reason for concern. In any case, I am sure some will say that a taper, such as a Morse taper, will benefit by the slight curve ensuring the taper fits tightest at its ends.

Another point to take note of is that the calculations were carried out assuming an error 0.5mm, surely greater than any readers would set a lathe tool. The acceptability of such errors are therefore a matter for individual consideration. However, this consideration will now be able to be made with some definite facts as to the magnitude of error likely, rather than a vague statement saying tool height will affect taper.

If however the method of setting the angle of the top slide or taper attachment as described in issue 6 page 28 is adopted (which incidentally has been proved by myself on a number of occasions), tool height is critical. The reason for this being whilst the method accurately sets the diameter at two points on the taper, they are not the end points. As a result if there is any curvature the overall taper from end to end will have an inherent error.

TRADE COUNTER

A first look at products which may be new to you

The Quick Step Mill

It is not often that a brand new machine tool can be reported, but we can this time. N.S. and A. Hemingway are introducing an exciting new machine tool that dramatically extends the scope of the centre lathe.

Designed for use on secondary operations after the workpiece has been turned, the Quick Step Mill can be fitted to the lathe in seconds. With a built in dividing head on the lathe, and no further set up, the result is fast, accurate work. It is ideal for milling, sawing, p.c.d. and cross drilling, helical milling, tapping, gear and spline cutting etc. It includes four axis feed and built in tilt facility. Also available are a range of collets.

The unit is available in two versions, standard and de-luxe, the main differences being that the de-luxe is supplied with more collets and a greater number of speeds. However the speed range is the same for both, being 110 to 4000 R.P.M. The unit runs in both directions, but is interlocked to prevent reversal whilst it is running.

All the electrical components are encapsulated, and therefore well protected from coolant and swarf. The unit is light and easy to handle, weighing just 4.1Kg.

For more details contact N.S. and A. Hemingway, 30 Links View, Half Acre, Rochdale, Lancs. OL11 4DD. Tel. 0706 45404.

Revolutionary New Pro-Bond Superglue Pen

Tufloc Industrial Products announce the launch of their new Pro-Bond Cyanoacrylate Superglues specifically designed for the serious model maker and craftsman.

Leading this comprehensive range is the totally new Superglue pen for accurate and fast one drop dispensing with cartridges of different grades of cyanoacrylate that can be easily inserted in the pen. This provides a very economical clean method of applying superglue, which avoids the blocking and short shelf life seen with the more traditional methods.

Supporting the Pro-Bond Superglue pen is a comprehensive range of full strength, unfilled, Industrial grade cyanoacrylates, activators and debonders specifically formulated to satisfy all the needs of the modern modelmaker.

For further details, please contact: Tufloc Industrial Products Ltd., P.O. Box 46, Easton on the Hill, Stamford, Lincolnshire, PE9 3NJ. Tel. (0780) 65135. Fax (0780) 63913.

Duradrive – a screwdriver with muscle

Here's a tool for everyone! This British made screwdriver gives you the power to remove stubborn old screw fasteners without resorting to impact drivers or power tools. First select the right head from the four available, swing out and lock into position, the large grip resin handle will then give you more turning force than any conventional screwdriver. If even more turning power is needed, simply swing out any other blade to 90 deg. to provide a 4½in. lever to turn the Duradrive.

Duradrive reduces the chances of stripping the head of a tight screw because it enables the user to push and turn at the same time. Ideal for loosening overtightened or corroded screws.

There are three versions of the Duradrive signified by the colour of the handle:

Red – 2 Straight and 2 Posidrive blades
Orange – 2 Straight and 2 Phillips blades
Black – 4 Torx blades

The four steel screwdriver bits are permanently built into the handle so there is no chance of losing them, and the bright colour of the handle means the Duradrive is easily located in tool boxes, cupboards, draws, etc.

It costs just £6.99 + £1.50 p&p. It is available only from Frost Auto Restoration Techniques Ltd., Crawford Street, Rochdale, Lancs. OL16 5NU, or telephone them on 0706 58619 with Access/Mastercard/Visa/ Barclaycard for next day despatch. (A full catalogue of specialist tools is available.)

1: *The kit as supplied.*

BLACK-IT

...PRODUCT REVIEW...PRODUCT REVIEW...PRODUCT REVIEW...

For many, the requirement to achieve a black finish on steel is a case of heat to red and quench in oil. This may not be too unsatisfactory if the item is small, but for many, the problem of getting even a slightly larger item to a red heat is too great owing to the low level of heat available. This chemical method of obtaining a black finish avoids that problem, requiring no heat at all. The resulting finish is also of a very high standard, comparable to what one might expect of professionally finished machine tool parts.

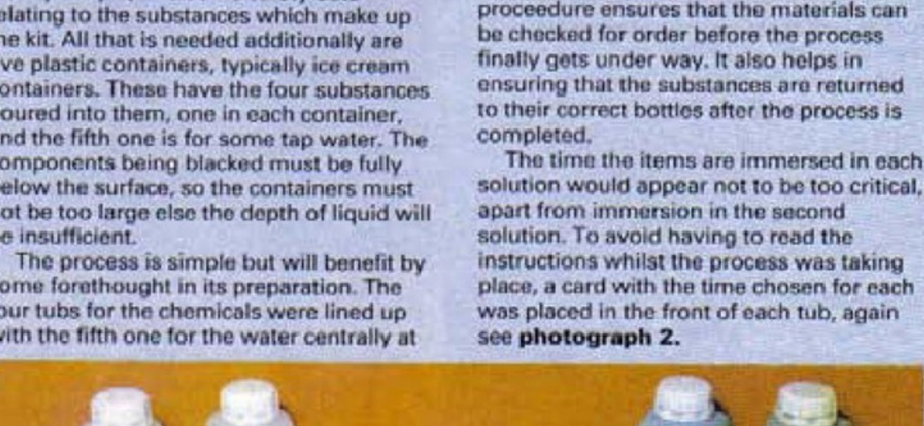
When, some months back a kit appeared on the market for blacking steel, it seemed like a good idea to acquire one to test. This was particularly so, as queries relating to the need to blacken steel quite frequently surface in the mail to *Model Engineers' Workshop*.

The kit comprises four plastic bottles containing 500ml of each of the four solutions used, as seen in **photograph 1.** Additionally there is an instruction sheet explaining the method, which in any case is very simple, and some safety data relating to the substances which make up the kit. All that is needed additionally are five plastic containers, typically ice cream containers. These have the four substances poured into them, one in each container, and the fifth one is for some tap water. The components being blacked must be fully below the surface, so the containers must not be too large else the depth of liquid will be insufficient.

The process is simple but will benefit by some forethought in its preparation. The four tubs for the chemicals were lined up with the fifth one for the water centrally at the rear. This is a good position for the water as it has to be used to wash the item between each of the other four being used, and enables the part to be easily moved to the water without dripping into adjacent tubs, see **photograph 2.**

The substances were poured into the four tubs in the order, left to right, that they were to be used, and the empty bottles placed at the back in the same order. This proceedure ensures that the materials can be checked for order before the process finally gets under way. It also helps in ensuring that the substances are returned to their correct bottles after the process is completed.

The time the items are immersed in each solution would appear not to be too critical, apart from immersion in the second solution. To avoid having to read the instructions whilst the process was taking place, a card with the time chosen for each was placed in the front of each tub, again see **photograph 2.**



2: *Set up, but waiting for the liquids to be placed in the containers. The numbers in front are the times in minutes in each liquid.*

3: The test samples prior to blackening.

Alkaline degreaser

This is the first to be used and an immersion time of 5 minutes is proposed. However, the notes suggest that if the items are very clean it can be less and more if very dirty. I chose 5 minutes.

Pre-conditioner

This is the most critical as far as time is concerned and proposes 1 minute stating that if more than 2 minutes the resulting blacking may be patchy. I chose 1 minute.

Blacking solution

The time quoted for this is from 2 to 4 minutes, with one set of instructions stating that it would result in a deeper black the longer the part is left in the solution. A second set of instructions did not make this point. I made two sets of test pieces and chose times of 2 and 4 minutes.

Dewatering oil

The time suggested is 10 minutes, but states that better rust protection would be achieved the longer the parts are left in the solution. I chose 10 and 20 minutes for the two sets of test pieces.

Test pieces

Two sets of test pieces were made up, one set short and the second set longer. It would be easy to remember that the shorter ones were in the solutions for the shorter times, and the longer one for the longer times. Four samples were made of each length from ⅜in. dia. BMS. Two of each set were turned to a slightly smaller diameter to see if the method was in any way affected by the surface finish. Each set of test pieces were hung on a wire frame so as to make it easy to move them from solution to solution. These are seen in **photograph 3.**

Method

The test pieces were placed in the solutions for the times already given, the cards in front avoiding the need to repeatedly refer to the instructions. They were moved from solution to solution in the order given above, but being placed in the water between each. They were agitated frequently at each stage so as to ensure an even effect. If a part was being blackened which has a flat bottom, it would be necessary to suspend it in the solution rather than rest it on the bottom. On finally removing from the dewatering oil the parts are hung to dry.

Result

The result is of course a subjective one and what may please one may not please another. Neither is it easy to describe in words the effect achieved. The sample left in the blackening solution for 4 minutes and the dewatering oil for 20 produced a very nice black finish. The samples left in for the shorter times also looked good but, when placed next to the others, it was noticeable that the coating was slightly transparent. This was slightly more noticeable on the machined portion.

The final result can be seen in **photo 4.** However how effective this is in illustrating the situation will depend a lot on the actual printing of the magazine. Another factor worth commenting on is that the samples prepared had on their unmachined portions some small rust spots, these were blackened but even so were still visible as marks on the surface.

Corrosion resistance

Another feature of the process is that, in addition to giving the parts a pleasing appearance, it is also claimed to provide some corrosion resistance. This will take some time to prove, and so this first part dealing with appearance is being published now. Samples will be placed in a number of differing situations and the results regarding corrosion resistance compared. An update will then be published as soon as something worthwhile reporting results.

Safety

In keeping with modern practice for such substances, the kit comes with a Product safety data sheet for each solution. These are written in what may be called official safety jargon, and may be a little off-putting to the average home workshop owner. They are of considerable use should a problem arise and expert help has be sought, so do not dispose of them.

With a little common sense there is no reason why the product should not be used with absolute safety. In simple terms, use rubber gloves and eye protection, wear some overalls or similar that can be easily removed should you spill any substance on them, and carry out the operation in a well ventilated area.

Supplier

The kit in its 500ml form costs around £25.00 including VAT and postage. Larger kits are available as is a gel-based kit for blacking parts in situ.

Another product, not tested, is one for producing an antique finish to brass and copper. This appears from the literature to be a single solution method and costs around £6.00 for a 500ml kit.

The solutions supplied in the Black-it kit are re-usable and fortunately the bottles supplied have large caps so that returning the liquid to its container is relatively easy. The solutions can be purchased individually should the need arise.

For further details contact Pixel-Plus Developments, Nailstone, Nuneaton, Warks. CV13 0PZ. Tel/Fax 0530 262565.

4: The test samples after blackening.

PLAIN MAN'S GUIDE TO MATERIALS – NON METALLIC

PART 3

Concluding this series on materials commonly used in the home workshop, Mr. Loader discusses the subject of non metallic materials. This covers a wide range, including materials such as wood, plastics and synthetic resin bonded materials more usually known as Paxolin or Tufnol.

Another group of materials which we couldn't do without is the non-metallic ones, both natural and man made. These include wood, glass, rubber, stone, diamond and all the synthetic ones which can be so useful.

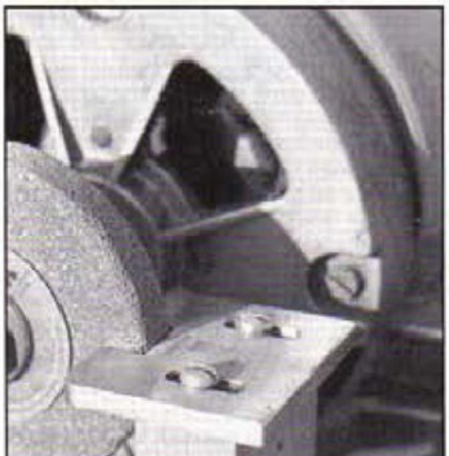
Natural materials

Engineers have always used natural materials and one of the most useful is wood. Wood for benches, hammer handles, file handles, casting patterns and many improvisations.

One of the best features of modern wood technology is what I call synthetic wood, chipboard and hardboard. Because of the way it is made, it is very stable, the particles are random, having no grain and to those like me, with limited skills with wood, chipboard especially is a wonderful invention. My Unimat is on a chipboard base, the base forms the top of a small chest with enough room in the drawers to hold most of the tooling. It is crudely made, but it works and the veneer on the material is synthetic and not affected by oil or grease in the way that wood would be.

Wood can also be used as the bulk of a fitting which, in metal, would be heavy and expensive, to say nothing of the time needed to make the part. The bits which have to be stronger and take wear can be fastened to the wooden part and made from any material which will do the job. The tool support for the small off-hand grinder I made was mostly wood with a piece of mild steel for the top plate where the tool rests. The photograph shows the method.

Handles for all sorts of tools are made from ash, beech, birch and hickory to name a few. I prefer the feel of wood, especially for hammers. The same goes for file handles. They need a bit of care in the fitting and a ferrule to stop them from splitting. If the file is burned in to fit one file, several others of the same size of tang will fit. A correctly burned in handle will last a long time and because files aren't continually being hammered into it there is less danger of it splitting.



Wood used in sympathetic fashion – here as a tool rest support on the bench grinder.

Small pieces of wood can be shaped to get into places where a file cannot get and smeared with lapping paste to smooth awkward corners which have to be finished off. The abrasive charges the wood and it only needs an occasional dip into the paste. It is a technique I used when I worked for a company which made small moulding tools for synthetic materials. The moulds have to be very finely finished, not only for appearance, but to help the moulding process to go smoothly.

A piece of wooden dowel with a flat end can be used in a similar way to make a decorated metal surface. The flat end is dipped in lapping paste and held in a drilling machine. It is used to make overlapping circles; known as engine turning.

Scrap pieces of wood are invaluable for putting under work being drilled, so that when the drill breaks through it does no harm. It is also useful to make a sandwich of two pieces of wood with thin metal in the middle, for drilling large holes in thin sheet. This is an operation fraught with potential mishaps and the method makes it safer, ensures a truly round hole and saves the bother of modifying the drill.

Some of the improvisations I have used wood for are best not mentioned; they come under the heading, 'it may not be technically correct but it works'.

Glass

A thick piece of old fashioned plate glass will make an emergency surface plate.

Lenses in the eye glasses and scale readers we use are still made from glass, as are the vials which contain the bubbles in spirit levels. It is also used as a filler in synthetic material, not only G.R.P. for the large jobs like boat building, but as a strengthener for nylon and other similar materials.

In the inspection field, optical flats are used to check the flatness of our micrometer spindle and anvil faces. If we can afford it, a modern digimatic measuring instrument works on an optical grating system. The glass used in the eye shields on grinding machines is specially made. If it breaks or gets worn out, DO NOT replace it with ordinary glass, get the proper stuff.

Glass is one of those materials we do not have to do much with. It sometimes needs a hole in it, good fun that. There are two ways of doing it. One is to drill it with a tipped drill. It works, but it is a nerve racking process and there is a 50% chance that the drill will split and shatter the glass when it breaks through. A better way and one which is easier on the nerves is to grind the hole through with a copper tube and lapping paste. The outside diameter of the tube is the hole size and if it is kept smeared with paste and run at a moderate speed, it will grind its way through and fetch out a nice neat slug. It takes a while and cannot be hurried but is safer than the drill and less likely to ruin the fancy bottle your nearest and dearest would like for a table lamp. Clamp the job as securely as possible and have something underneath with a bit of give in it.

Rubber

This material is a sort of hotch potch and in most of the substances we call rubber, there will be some synthetic additions.

The rubber we know best is the one which is used for the driving belts for our machines. This is where the small lathe owner misses out. The 'O' rings used for our driving belts do not last long enough, so much so that I always used to have two spares, just in case I got caught out. I would rather pay for belts made from insertion rubber, the sort with cloth moulded in for strength, than the pathetic sort the makers use. I have raised the question with the representatives on the stands at the exhibition. The answer I got was, 'wait till the next model and it may be different'. I got fed up with waiting and half-solved the problem, as another of our contributors has by buying vacuum cleaner belts. Although they are not quite the right size, they are cheaper and last a lot longer, the only snag is the deposit of black rubber that they leave on the pulleys. The rubber cleans off with a little meths and a lot of elbow grease and the size difference doesn't seem to have a lot of effect on the performance, but I don't see why small lathes shouldn't have the same tough vee belts as the larger ones. So please, anyone who reads this and works for a rubber company, have a go at the boss and see what you can do.

The rubber used for Unimat belts is probably a type called neoprene and for what it is normally used for it does a good job, it is oil, heat and abrasion resistant. Of the others, nitrile rubber is good for gaskets, sealing and hoses, and butyl rubber will be in tank linings and hoses because of its resistance to chemicals.

Rubbers of one sort or another will be in anti-vibration mountings, coolant, hydraulic and pneumatic pipes, 'O' rings and Dowty seals, it is a good material for sealing pipe work joints and unions where a leak can be not only costly but sometimes dangerous.

It is a material we would not have to machine in the normal run of work and the nearest I ever came to doing so was when a gearbox had oil seals in the bearings. The output shaft of the box had to be very free-running and the seals prevented this, so I had to do something about it. The best solution I found was to open out the seals with a rotary file. It did the job, took a long time and the gearbox leaked like a sieve afterwards, but the powers that be seemed to be happy. Since then I have thought of rubber as a material best supplied in the form we are going to use it in, perhaps a little cutting of sheet, but that's the limit.

Stone

Stone would seem to be an unlikely engineering material, but a lot of engineering has its roots in mill work and milling wheels for grinding floor were made from natural stone called millstone grit or grindstone grit. Some farmyards will still have a large stone wheel used for sharpening scythes and grass hooks.

Throughout history people have improvised when it was necessary, to sharpen an edge of a cutting implement. My wife can remember going with her junior school class to see the church wall in St. John's churchyard in Worcester where Cromwell's troopers sharpened their swords before the battle of Worcester. One of the most evocative sounds I can remember was the sound of my Dad sharpening the carving knife on the back doorstep. The rasping noise meant roast lamb or beef with peas and new potatoes in those long ago, always sunny, summer days.

There are other natural abrasives. When I was a recruit in the Royal Air Force and detailed to clean the wash basins, I was told to use something called 'airth' as a substitute for the non-existent scouring powder. The corporal in charge was broad Scots and being a country lad, I took a long time to realise that the magic substance was earth. It did the job, the same way it used to clean our pen knives when we plunged them into the ground a few times when we were lads.

The nearest to a natural abrasive we use these days is emery, apart from diamond that is. Emery is an impure form of corundum found in various locations, mostly in the district we used to call Asia minor. It is pretty hard stuff, 8 on Moh's scale, where diamond is 10.

There are many references to emery in engineering history. In 1765 a man named Bowles wrote about, 'great blocks of emery stone', and there is a mention in a watch and clock making manual of 1884 to, 'a solid stick of emery used as a file'. There was even something called 'grinding money', which was paid to men in the barge building trade for time allowed for sharpening tools when the job was finished. Wheels they used were made from wood and leather with the emery stuck to them with adhesive.

Emery is still used today for the cheaper emery cloth and for non-skid floors and stair treads, but what we call emery cloth is quite often made with the more modern abrasives, more about them later.

There is a type of stone used extensively for surface plates and tables, parallels, vee blocks and other shapes used in inspection and standard rooms. It is black granite, found in California and it has advantages which metals cannot match. It is very stable, doesn't corrode, can be made very flat and accurate and is non-magnetic. Accidental knocks and bangs do not raise burrs. I have a miniature surface plate which was given to me by a representative of a tool company, it is very small, about 3in. x 2in. and the only accurate surface is the top, but if I need a small accurate surface it does very nicely. I think it was intended to be a paper weight.

Marble tops from old fashioned wash stands make good surface plates as do the marble cheese boards found in some specialist shops, but check the flatness with a straight edge before using them.

For sharpening, most of the materials we use will be made from aluminium oxide or silicon carbide. There are others: 'Arkansas' stones are made from a natural stone called Novaculite, which is a very close and hard stone for fine and delicate work. 'Water of Ayr', or 'Scotch' stone is soft and wears quickly. It is used wet and can be shaped by filing if necessary. I have one of these but I don't like it much, my first and best choice is always the trusty India stone. They are made from aluminium oxide fine abrasive, oil filled when they are made and will keep their shape and last for years. I use them for touching up high speed and carbon tool steel tools and for sharpening the cutters in my electric razor. There are many shapes and sizes and every turner usually has one in his pocket.

When a tool needs more than a stone will manage, the grinding wheel has the job. There are two abrasives used for the sort of wheel we use, aluminium oxide and silicon carbide. Aluminium oxide is the metal ore fused into a solid mass, broken up and crushed into grit. The grit is graded into sizes and made into grinding wheels, lapping compounds and India stones for use on the steels.

Silicon carbide is made in a similar way from coke and sand with small amounts of other things. The mixture is fused in a furnace into a clinker. The clinker is treated in the same way as the aluminium oxide and used to make the same products, the difference is that the silicon carbide is used for grinding carbide tools, cutting stone and marble, and for grinding non-ferrous metals.

Diamond is the pinnacle for hardness. Those used are the industrial grade, but still expensive. They are nothing like the ones your nearest and dearest likes for decoration, but those which are not suitable for jewellery because of colour or other defects. Whole diamonds are used for setting in a length of steel rod to use for dressing grinding wheels, crushed ones for Dialap compound and setting in a matrix to make diamond grinding wheels and hones. The hones are used in the same way as the India stones, except that they will touch up carbide tools where India stones will not.

Synthetics

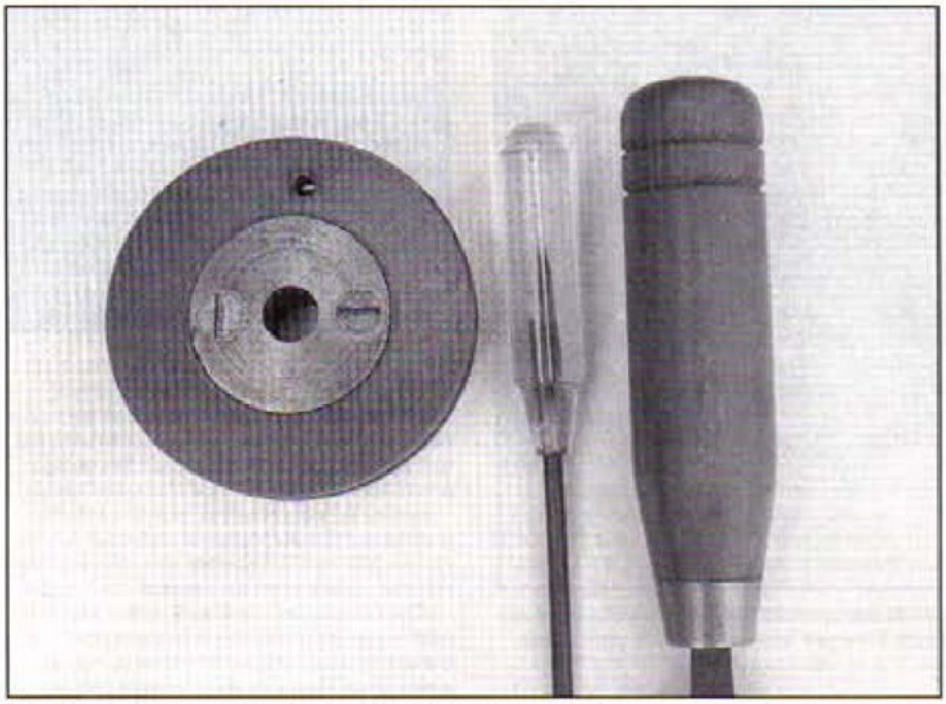
The other group of non-metallic materials are the synthetics. We call them plastics, but it is not strictly correct to do so because it confuses them with one of the properties of materials; the ability to be deformed without damage. Some synthetics have this property, but not all, so I will do my best to avoid calling them plastics.

In general, synthetics have a lot going for them and are very useful *if they are used wisely*. They are used more and more to replace other materials, not always for the better, as many a car owner will know, or anyone who has had a self-tapping screw strip out of a synthetic part in a vacuum cleaner or other so-called consumer durable. But they are light, quite cheap, easy to mould and shape and have good insulating properties, with one or two exceptions. Carbon fibre is no insulator, as some anglers have found to their cost when fishing near overhead power lines. Some of the things which make them a good material in some ways can be a pest in others. The use of them for making bottles is the reason why the bottles are always falling over in cupboards, the stability which the weight of glass gave is no longer there. For some things though, they are excellent; I have seen and handled a pair of very tough synthetic tyre levers which were a free gift with a cycling magazine, it should make life a lot easier for spoon handles, and they must have been cheap enough, to give away.

Another instance of the replacement of other materials is in the photographic industry. My wife recently changed her

QUICK TIP

Annealing aluminium sheet has to be done very carefully, due to its low melting point (650 deg.C). It should be heated to around 400 deg.C. and allowed to cool in air. An effective method of gauging when 400 deg.C. has been reached is to coat the work with a film of ordinary soap. When the temperature has been reached the soap will turn black. **Alan Jeeves**



Handles made from various materials, left to right: Tufnol, hard plastic, and the traditional wooden handle, which many still swear by as being the most comfortable.

camera. She uses a single lens reflex with some skill; many photographs illustrating my articles have been taken with her help and some of the really good ones have been hers, especially when I have no extra hands to spare. Her new camera has more synthetic materials than any other. The saving on machining and material costs must be one reason why a good SLR doesn't cost a fortune.

A lot of information about synthetics would be too technical and there are so many of them that it would be a job to sort them out, also a plain man doesn't need it. I'll concentrate on the ones we see most. There are two sorts, thermo-plastics, which will soften with heat, so that they can be re-moulded and shaped, and thermo-setting ones which will not soften but burn when they get hot enough.

Thermo-plastics are mostly flexible and tough, some can be fairly hard, but remember that toughness is a measure of how much a material can be bent, twisted or deformed without damage and has little to do with hardness. They include polyethylene, polystyrene, PVC, Perspex, Nylon and PTFE. A lot of these are trade names, Perspex is really methyl methacrylate or acrylic and PTFE is polytetraflouroethylene, hardly surprising that we use the trade names or abbreviations.

Nylon

There are several grades of nylon, the most popular are 66 and 11. All nylons have a low coefficient of friction, will take shock loads, resist solvents and most acids, are tough and flexible and have good electrical resistance. These properties make them suitable for small gears, cams, bearing bushes, cable insulation and locking inserts in nuts. They resist heat up to at least 140 deg.C. These are just a sample of the uses. I can vouch for the effectiveness of Nylok nuts; I once worked on a job where there were thousands of them. They work like the old red fibre ones, the bolt forces through the nylon insert and jams the nut and bolt threads together at the thread flanks. Because the nylon is resilient and flows with the pressure, they can be used over and over without any deterioration. I never knew one fail.

Nylon 66 can be improved by using short glass fibres as a strengthener. The fibres are 2mm. and known as a filler. The effect is to make the nylon stronger, more rigid, and overcomes one of its faults, the absorption of small amounts of water. These materials are used for the housings of electric drills and similar jobs.

An even tougher version is Nylon 66ST, 'super tough'. This one has some synthetic rubber mixed in. The extra toughness is at the expense of some of the rigidity and it is a bit more difficult to mould and machine. It is used for highly stressed components like gears in lawn mower starters.

Nylon 11 is a more expensive one than 66 but is more flexible, tougher and absorbs less moisture, so it is the best one for petrol hose and pneumatic and hydraulic pipes.

Polythene

This is a low cost, very tough and flexible material with very good chemical resistance and insulating properties. Most of the workshop uses are in electrical cable and piping and squeeze bottles for coolant. It won't stand heat above about 75 deg.C. which limits its usefulness for some things.

P.V.C.

Similar to polythene but stronger and used for protective clothing and gloves for people who are exposed to chemicals. Very good for clear view tubing and cable insulation. Another inexpensive material which can be made as sheet for safety curtains and packaging.

Polystyrene

This is easy to make as a foam, so it is found a lot in the packing which protects goods in boxes. Its excellent insulating properties make it ideal for ceiling tiles and other household insulating jobs. It can also be made transparent, so it is the material which is used for cassette and CD cases; these are very good for making eye shields or chip guards. They are cheap to buy and just need a hole or holes drilled for attachments. They are also easy to stick with the right adhesive. Drilling and cutting has to be done carefully because the material is brittle.

Perspex

When used as a transparent sheet Perspex has very good light transmission properties, good enough to make lenses. It also takes colour very well and the shop name displays which light up are usually made from it. It is moderately expensive but used for many things from false teeth to car rear lights. It will mould beautifully when hot, but burns easily when too hot.

P.T.F.E.

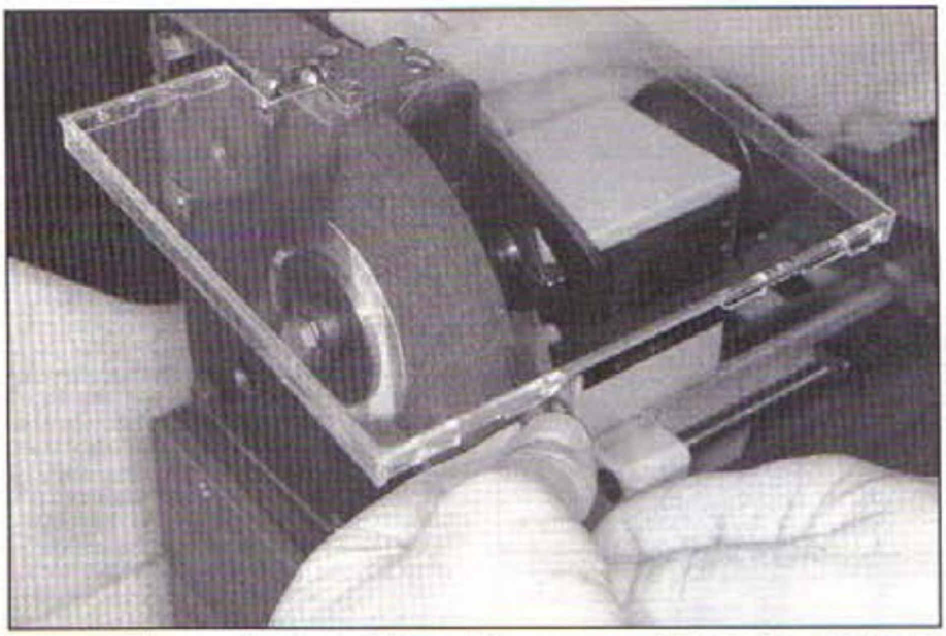
This is a bit of a funny one, very expensive and quite difficult to mould. So it is usually available in ready to use things like sealing tape and piston rings for low temperatures, block, sheet and rod. The reason for the moulding problems is its high temperature tolerance, it can stand up to 300 deg.C. without damage, very unusual for a thermo-plastic. It insulates very well and resists all corrosive acids and chemicals, even the mixture of concentrated nitric and hydrochloric acids called 'aqua regia' will not touch it, even though it will dissolve gold. It has an extremely low coefficient of friction, which is why it is so good for bearings and sealing tape: on the domestic front, it makes the Teflon non-stick coatings on frying pans and the coating on stainless steel razor blades to make them slide easily over the skin.

Long ago, when I was a youth, we had a special technical instruction circulated about PTFE. An STI was the ultimate in 'you must obey'. The gist of it was that it gave off toxic fumes at temperatures above 350 deg.C. I cannot remember if it was ever proved, we certainly didn't experiment!

Polycarbonate

This is another material which, although expensive, has good chemical resistance and is very tough. It makes good tool handles, protective shields and particularly good safety glasses. If the advertising is true they can be run over by buses, have steel balls fired at them and other indignities thrust on them, without damage. Personally, I'd rather have them to use over my spectacles to keep my eyes safe, but, joking aside, they are very good and should be in everyone's workshop.

These are a few of the many thermo-plastics. As for the machining of them, some have their own little ways, but in general, use speeds of 200 ft./min. and more if they will take it, rake angles of 15 deg. and clearances of up to 10 deg. to stop the tool from dragging. Tools must be dead sharp, if they aren't the material will try to flow with the cutting pressure. When drilling use a pilot drill so that the final drill has an easy job. Avoid threading thermo-plastics if possible, if you must, use as coarse a thread as you can. It is better to use threaded inserts made from brass with the outside diameter knurled. If these are



A very sensible precaution – in fact it is mandatory in commercial shops. A special glass, or Polycarbonate shield over a grinding wheel protects the eyes from flying dust and debris, and, protects the operator if a wheel should burst.

heated and pressed into a smaller hole, so that they are an interference fit, the material will fuse round them and grip securely. You will have to try out one or two on some scrap of the same material first to get the heat right, but it is a very good way of putting a thread in a material which otherwise would be awkward. If you can get them, Helicoils are good too.

Remember that thermo-plastics soften when hot, so keep the machining process cool by using weak coolant, weak because the main function of it will be to cool; lubrication is secondary. If your circumstances do not allow you to splash coolant about, do the job bit by bit. When turning the flexible materials, the swarf tends to pile up rapidly round the tool and everything else, so have pliers ready to clear it. When roughing out, keep stopping the tool to break the ribbon.

Be careful when using nylon or PTFE for bearings and give them a bit more clearance than you would with metals. Aim for a free running fit, even a bit of play, because it is possible to have them seize if the clearance is too small. One point in their favour for bearings, is their low coefficient of friction, it means that they do not need much lubrication.

Some thermo-plastics aren't very stable, so do not expect very high precision from them. It is quite possible to make a dimension spot on at knocking off time and find it quite different the next morning; I write from bitter experience! It is due to changes in temperature or humidity or both.

I've had some awkward jobs to do with thermo-plastics at times. I once had to counterbore a length of PVC tube. It had a bore of ¼in. and an outside diameter of ½in. The bore had to be counterbored ⅜in. and the depth was about 1½in. It was done with a home-made cutter with a very thin blade gashed at intervals, so that there was the minimum of cutter in contact. I cannot remember the details of how I held it, but it was done on a lathe.

Distrene is another funny material, transparent and easy to machine, but with some peculiar effects. I had to make some washers, ⅜in. diameter and ⅛in. thick with a ⅛in. hole. Some were all right and some developed splits raying out from the hole. It made no difference how the hole was drilled, or how many times I sharpened the drill, I had to make about a dozen to get four good ones. Some of the cracks appeared overnight. I never found anyone who could give me a satisfactory explanation.

Some of the more rigid thermo-plastics make good handles for screwdrivers and other tools which need a permanent handle. I have several made from Perspex. If the tool tang is made to a tapered square section and holes drilled in the handle to give the same effect, the tang can be heated and sealed in by pressing it in while it is hot. Brown or purple is the colour to heat it to.

For filing or sawing, use sharp blades and files; thermo-plastics are very 'skiddy' and blunt blades will not grip. Saws should have as coarse a blade as possible and the speed should be fairly slow. Any material will play up if the saw is used like a scrubbing brush, synthetics more than most. Some of them will melt with the heat and the saw blade can jam. The man who made the saw blade put teeth all along it and intended them all to be used!

Some thermo-plastics will cut like glass in the thinner sizes, Perspex and polystyrene especially. Just scribe a nice deep line with a sharp scriber and they will break to the line when bent. For the same reason, be careful when sawing because they split very easily; avoid this by firm clamping and minimum overhang. The edges of some will cut like glass too, Perspex is one.

Thermo-setting setting plastics - Tufnol

Remember that the thermo-setting ones are the ones which cannot be softened by heating. A lot of them are used with fillers mixed in for strength, or as laminates, the most used ones being the Tufnol or Bakelite ones. As there is little difference between them and it is only a trade name, Tufnol is the one I'll concentrate on.

It is made by impregnating sheets of paper or cloth with a resin, laying lots of sheets in a press and pressing and heating the stack. The heat cures the resin, and the pressure bonds the layers into a solid sheet. If a decorative surface is wanted, the top sheet of paper or cloth has the design on it. A similar method can be used to make tube, rod and other shapes. Cloth grades are the strongest and can be recognised easily because the weave of the cloth is clearly seen on the surface.

The cloth grades are very good for making gears, pulleys and bearings, especially bearings which have to run in water or other fluids with limited lubrication properties. It is quite strong, an excellent insulator and not too costly. It will start to burn at temperatures over about 150 deg.C.

Tufnol gears are often used in machines and I know of several elderly Colchester and Harrison lathes with Tufnol gears in the train from spindle to gear box. They are much quieter than metal ones and easier to make. Like Perspex, Tufnol in the rod and round shapes makes good tool handles, but they need a ferrule to prevent splitting. In thin sheet sizes, it has enough spring to be used as leaf springs in model locomotives and rolling stock. The top and bottom ones are steel, all the rest of the stack are shaped Tufnol.

QUICK TIP

If you require steel parts blueing, an easy way is to buy a ready made chemical preparation from a gunsmith's shop or shooters' supplies. You can also obtain a solution to colour steel a deep brown. These products are easily applied and usually give first class results. **Alan Jeeves**

Epoxy resins

These are used a lot as adhesives like Araldite, which is a good method of sticking metals together when all other methods fail. It will stick unlike materials together too, a boon when wood must be fastened to metal or similar jobs. It is expensive but lasts a long time, I buy a new pack of Araldite once in a blue moon. It is also used for part of the glass fibre used for making boat hulls and other shapes and for potting and casting. At one company I worked for, where one of the products was miniature transformers, one of the transformers would be potted in resin and then cut in half when set, and polished. It would be displayed at trade fairs under a powerful magnifying sheet, and very impressive too. The firm's chemist, a chap we called Merlin, used to do the potting which wasn't as easy as it would seem. The main problem was to make sure that there were no bubbles. I had no such trouble when I had to have some potting done. My miniature 'Walkman' played up and wouldn't record. As it takes miniature tapes and they have to be recored it was a grave problem. My son-in law, an expert practitioner of the black arts, identified the fault and replaced the circuitry. I made an aluminium can ⅞in. long and ⅜in diameter with a 5/16in. hole in it, and he built the whole thing into it, stereo plug, the lot. To make sure that it didn't move we potted it with Araldite. It has been no trouble since.

Carbon fibre.

Very fine carbon filaments can be bonded with cold setting polyester resin to make carbon fibre. The material is strong and light. It is used as a strengthener in racing car parts and in the braking systems. It also makes very flexible fishing rods, the only problem the one I mentioned previously, it conducts electricity.

As with thermo-plastics, the thermo-setting ones have many more types and variations than I have space to deal with, so as before, I have tried to give some idea of the ones we are likely to use most.

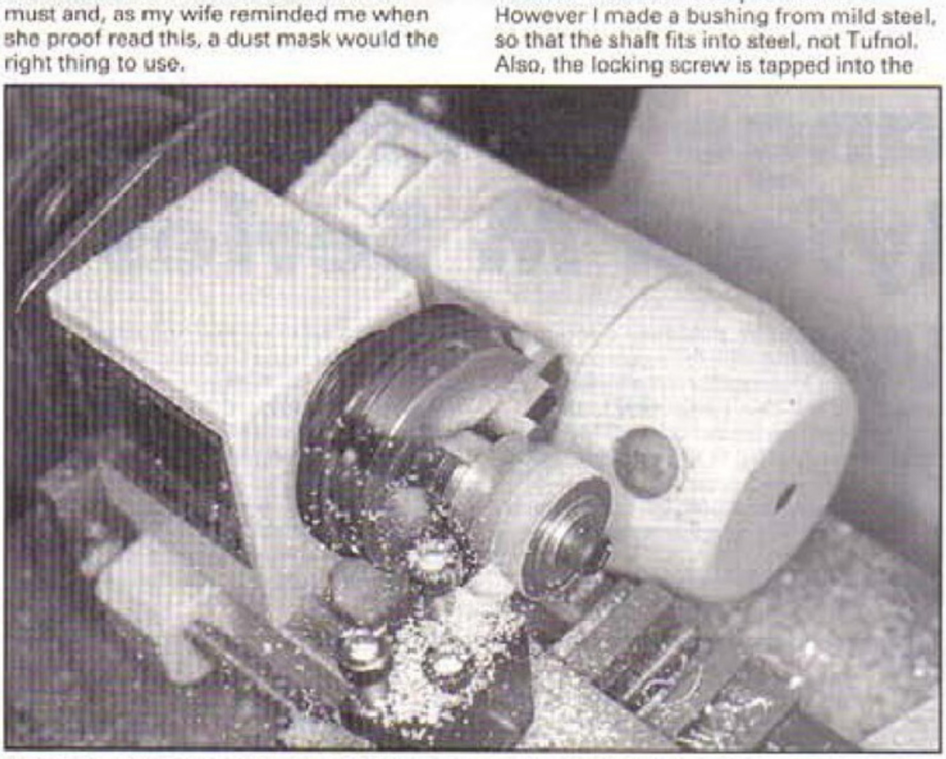
In general the advice for machining and cutting Tufnol will serve for most of the rest. So it is easy to machine with a large rake, up to 30 deg., with 5-10 deg. clearance, at as high a speed as conditions will allow. Swarf will be extremely dusty and it is best to machine dry. Clean the oil off the slides before starting and re-oil when finished, because the dust gets everywhere and makes a sludge with the oil. Avoid machining Tufnol if you have a cold, it will make the stuffed up nose and sore throat worse. Good ventilation is a must and, as my wife reminded me when she proof read this, a dust mask would the right thing to use.

the Tufnol between aluminium discs of slightly larger diameter.

The laminations will cause trouble when drilling or tapping with the grain, so don't do it, always tap across the grain. If the job doesn't split when it is tapped, it will when the bolt or screw is tightened.

Many synthetics of both types can be re-cycled. The CD cases and cassette cases I have already mentioned, but there are simpler ones than those. If you have a small lathe, some very simple ones indeed. Next time a shirt is beyond repair, cut open the collar points and take out the stiffeners. They will be of nylon, about 3/32in. by 1/32in. and 2in. long, just the right size for packing to go under the tools on my Unimat. They are more resilient than metal too, and will damp out vibration better.

Don't expect too much from synthetics, they are not always right for every job, sometimes they fail because we expect too much. A little thought when choosing your materials helps. For instance, the pulley which drives the milling/drilling head of my Unimat is made from cloth bonded Tufnol. It was right for the job, available in a reasonable size and easy to machine. However I made a bushing from mild steel, so that the shaft fits into steel, not Tufnol. Also, the locking screw is tapped into the



Machining Tufnol, high speed and feed combined with really sharp tooling ensures success, but the swarf comes off in the form of a dust as can be seen in this action shot. Use of a dust fulter to aid breathing and avoid ingestion of the dust is a sensible precaution.

Tools for machining Tufnol should be freshly ground and not stoned. The resin in the material has an abrasive effect and blunts a tool quicker than you'd like, if it has been stoned. Drill and tap dry and use sharp drills, if there is any doubt, grind them first. Ream with a sharp reamer. If you haven't got a sharp one, make a quick D bit, it can be made from case-hardened mild steel, or even from unhardened mild steel, if there is only one or two holes to do.

Because of the way Tufnol is made, it can be a problem when the laminations split out under cutting pressure. This can happen at the end of a cut, especially when making gears or any shape which has a slot or form in it. Apart from the sharpest tool, the other thing to do is to back the job at each end with a thin piece of other material. When I made gears, I sandwiched

bush so that its thread is in steel, not Tufnol.

Allowing for their lack of some properties, synthetics are exactly right for some things. When I remember how I used to laboriously carve model aircraft from the blocks of wood supplied and compare it with the modern kits, I can see the advantages very clearly! The wealth of detail which can be moulded into modern kits is a tribute to the skill of the chemists and development engineers and, not least, the skill of the mould makers.

No list of non-metallic materials we use would be complete without those we use for improvisations: things like paper, Plasticene, string and cardboard, to name a few.

Plasticene once made all the difference to an awkward job when I had to bore out some thin tubes in hard brass. Whatever I tried, the job chattered and no combination of feed, speed or tool grinding seemed to make any improvement until I moulded Plasticene round the outside, nice and evenly and about 1/8in. thick. It damped out the vibrations and the chatter marks vanished.

Given the same problem again, chatter caused by vibration, I always reach for the plasticene. If there is no Plasticene, string will often do the same. Apart from eliminating chatter, Plasticene is useful for making 'sticky pins'. These are not as high tech as they sound, merely a pin stuck in a lump of Plasticene, which is in turn stuck to a solid part of a machine to make a reference point. For instance, it could be used to hold a pin on the tool post of a lathe, so that a job in a four jaw chuck could be turned slowly by hand and roughly set using the pin as a reference.

Both millers and turners often use Plasticene to channel coolant back into the reservoir, instead of dribbling over the slides or on to the floor. Some, especially millers who often have to just stand there while long cuts go through, amuse themselves by constructing miniature river systems.

Paper has many uses and there will be many different thicknesses in any home, all they need is measuring. Cigarette papers are the favourite because the green and red ones are 0.0015in. and never vary, those in the green and red packets, that is. They are very good for setting up milling cutters. If a cutter has to be set against an edge, the paper is held between cutter and edge and the table moved until the cutter just drags the paper, it is then near enough on the edge and it can be done so that there are no marks on the work. The cutter must be revolving of course, and fingers kept out of the way, except for the two needed to hold the paper.

I have used paper of many thicknesses to correct small errors in setting up, or to set work at very small tapers. It is a particularly useful technique to use when surface grinding because the magnet still works through the paper. It has got me out of trouble many times!

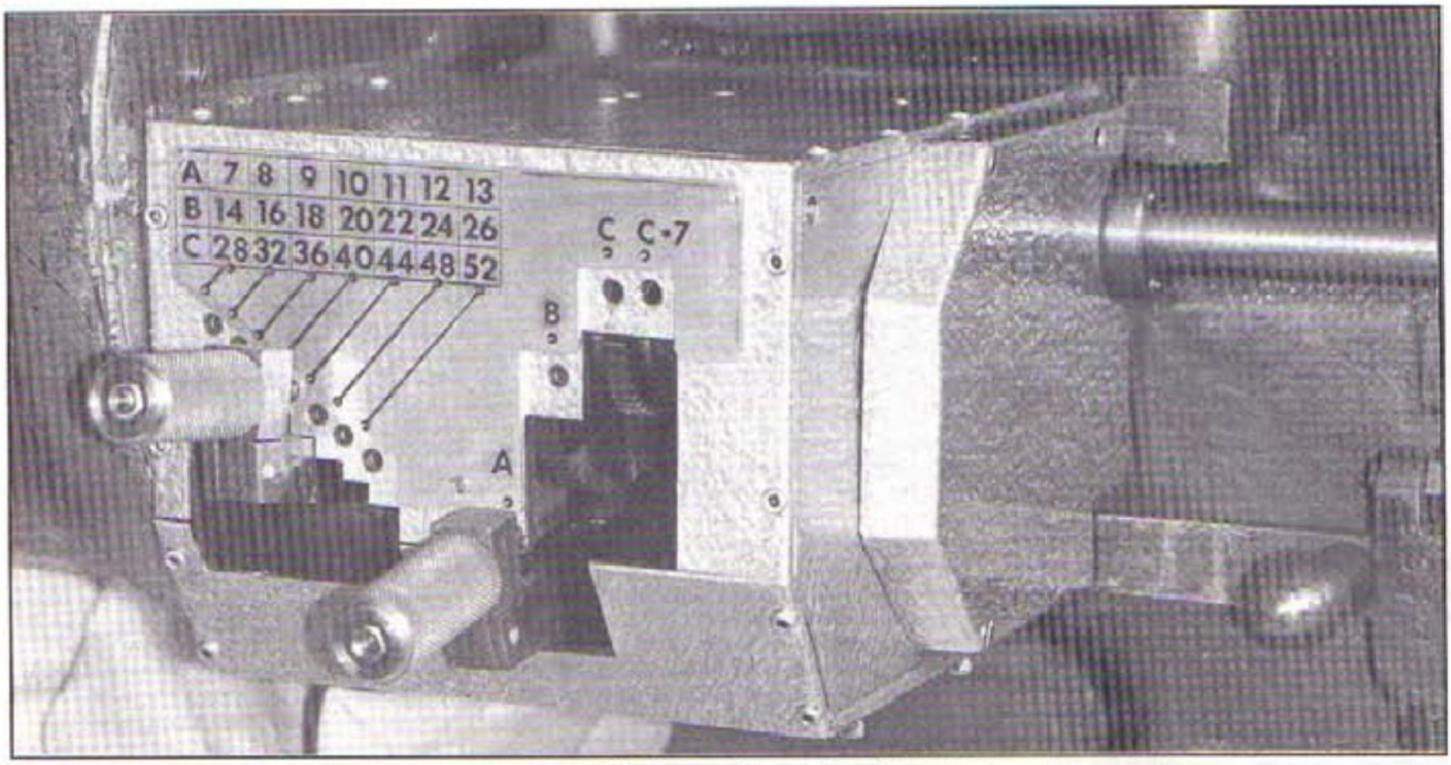
Paper is a good gear setting aid for getting the backlash right. A piece of suitable thickness trapped between two meshing gears will be enough to give the right clearance. The gears are locked, then when they are rotated, the paper falls out. If a single thickness isn't enough, the paper can be doubled or a thicker piece used.

Thicker paper and cardboard makes a protection between vice jaws and work to avoid damage on a finsih which is worth looking after. It can also be used to pack the jaws of a three jaw chuck which doesn't quite run true. To give some idea of thicknesses, bank typing paper, 45 gram, the stuff used for copies, is 0.0025in. Ordinary writing paper is about 0.004in. as is 70 gram bond typing paper, the sort used for the top copy.

Yet another use for thick paper or card is as a packer between the base of a turning tool and the tool post, not as an aid for centring, but to do the same job as Plasticene, reduce vibration and chatter.

A lot of the pleasure in model engineering, is the choice of materials to do the job. I always get a lot of fun from wondering what I can get away with. Knowing a little about our materials can often help us to make the right decision. A case of a little knowledge being a good thing.

In all your projects, may you choose wisely.



The finished gearbox, installed on the lathe. Note the neat indicator plate made and fitted by the author.

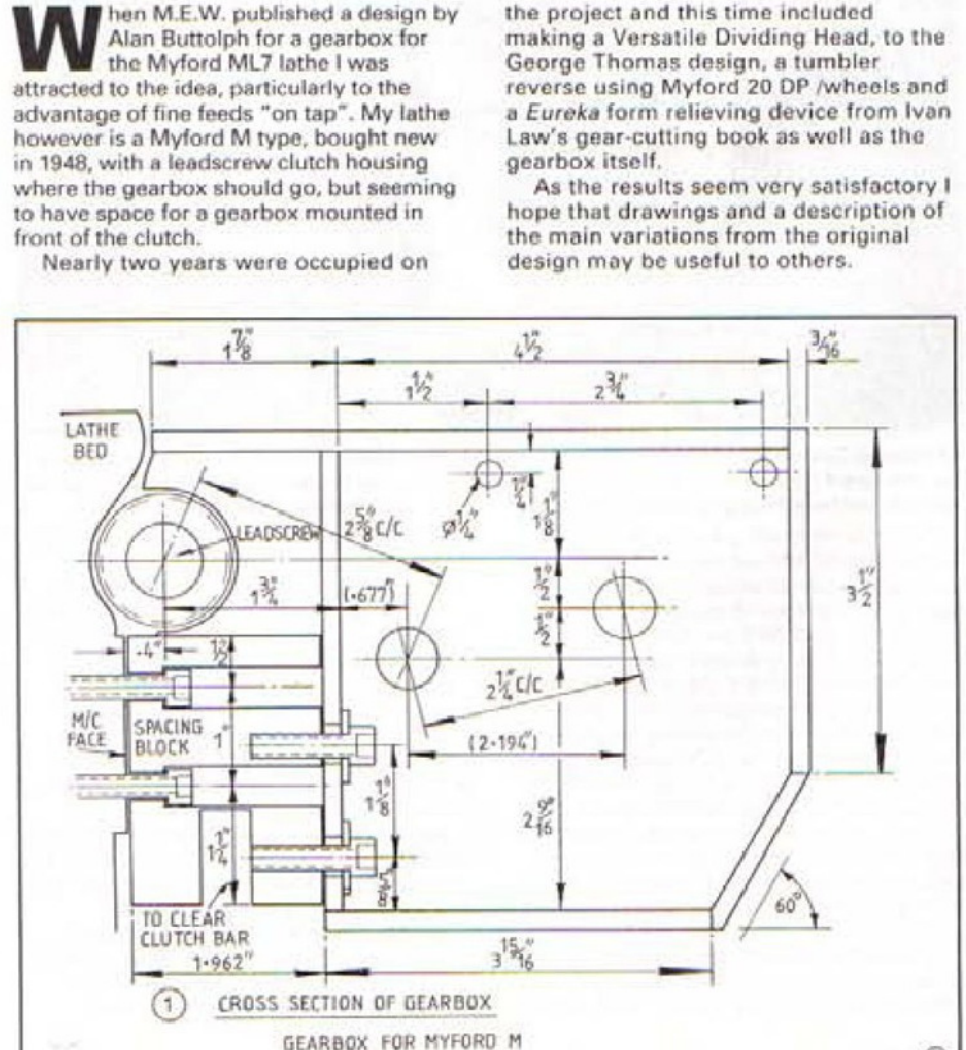
Quick Change Gearbox for the Myford M Series

A number of readers have taken the design for the Myford ML7 quick change gearbox, published in the Winter 1990/91 issue of *M.E.W.*, and modified it for their own particular lathe. In this article Mr. G. Pratt shows how he adapted it for his Myford M series lathe. Would be constructors of this variant are advised that this article should be read in conjunction with the one mentioned above. Photocopy reprints are available from Photocopy Service, Argus House, Boundary Way, Hemel Hempstead, HP2 7ST.

When M.E.W. published a design by Alan Buttolph for a gearbox for the Myford ML7 lathe I was attracted to the idea, particularly to the advantage of fine feeds "on tap". My lathe however is a Myford M type, bought new in 1948, with a leadscrew clutch housing where the gearbox should go, but seeming to have space for a gearbox mounted in front of the clutch.

Nearly two years were occupied on the project and this time included making a Versatile Dividing Head, to the George Thomas design, a tumbler reverse using Myford 20 DP /wheels and a *Eureka* form relieving device from Ivan Law's gear-cutting book as well as the gearbox itself.

As the results seem very satisfactory I hope that drawings and a description of the main variations from the original design may be useful to others.



1 CROSS SECTION OF GEARBOX

GEARBOX FOR MYFORD M

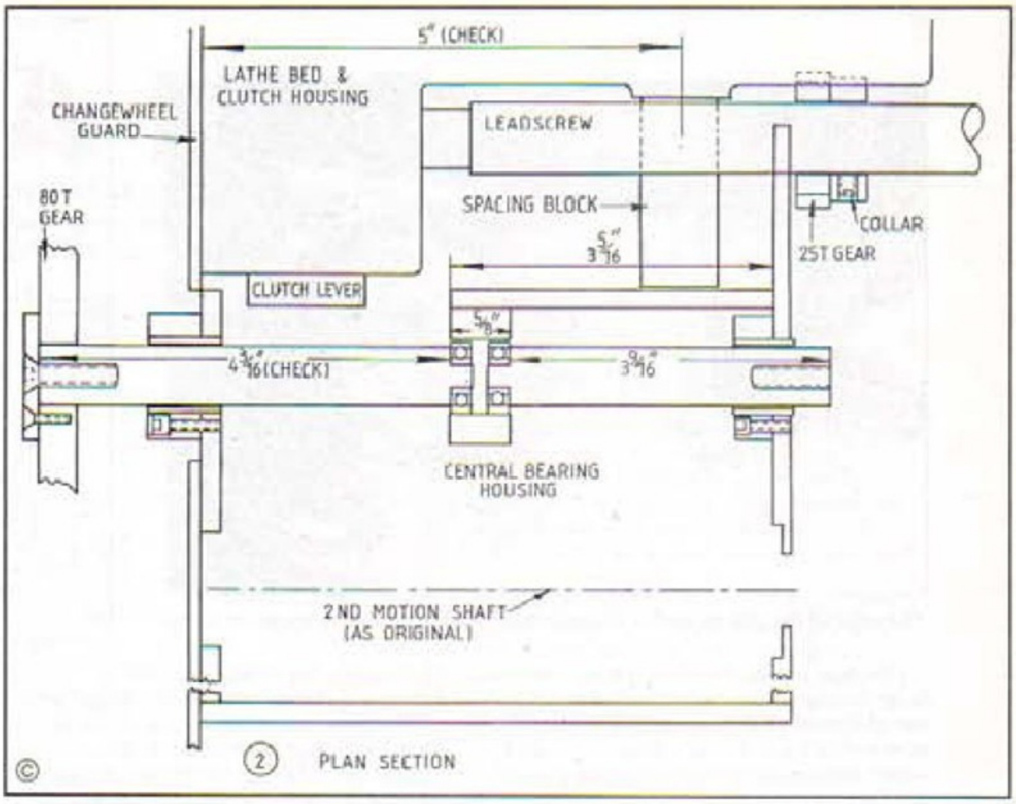
General layout

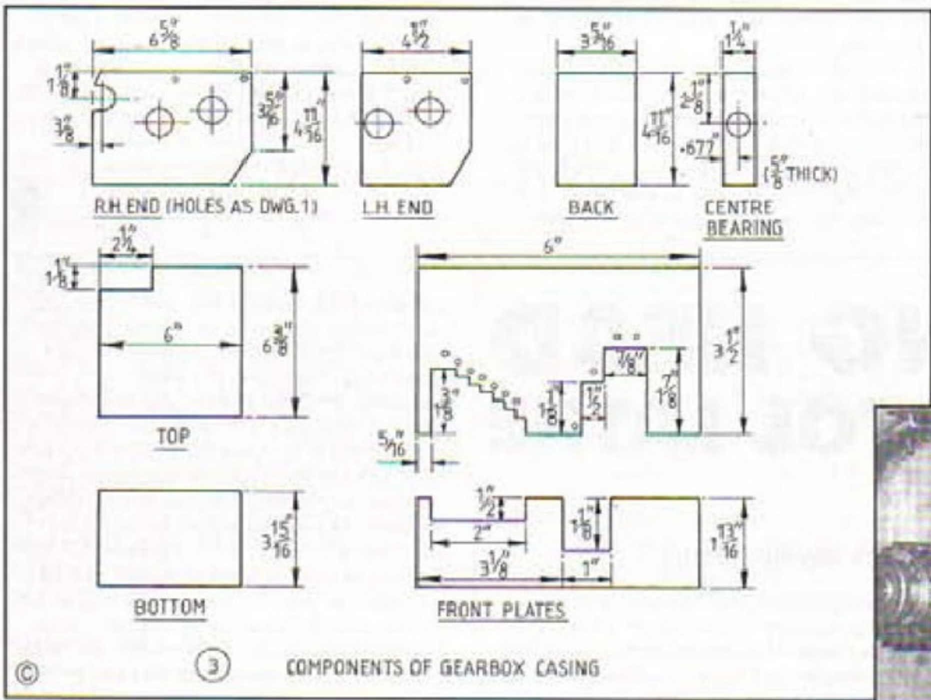
In order to leave the leadscrew unaltered the gearbox was made complete in itself. The input and output shafts carry 80 tooth 20 DP Myford wheels and 25 tooth wheels complete the drive, one loose on the end of the leadscrew driven by changewheels from the mandrel and the other bored out to ⅝in. and fitted with a collar with grubscrews to drive the leadscrew.

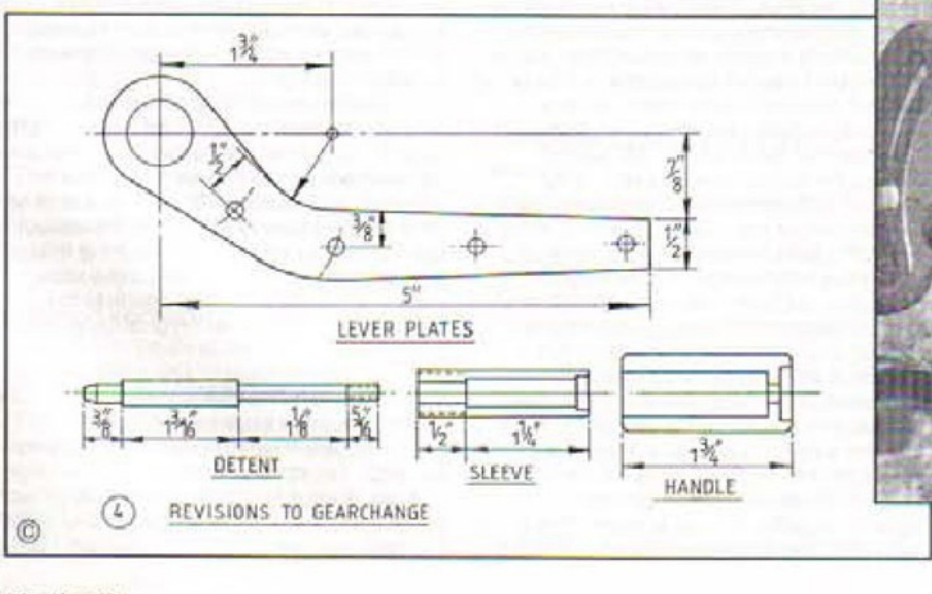
The lathe has a machined pad about 2x1in. on the front of the bed below the headstock and this was used, with a spacing block, as the main gearbox mounting. The left-hand endplate of the box is bolted to the steel backplate of the changewheel guard. In both cases the bolts are ¼in. dia. in ⅜in. holes to allow adjustment of mesh of the 20DP gears.

The curved front plate, in ³⁄₁₆in. MS of the original design was quite beyond my workshop facilities, so I have used two flat plates. This makes the gearchange lever openings easier to form, and the lever shape is altered as well. The dimensions of the openings were determined by trial and error and should only be used as a guide.

The dimensions of the gears within the box with keys, keyways, spacers etc. are as the original design. I have used 6mm and 8mm ball bearings as they are cheaper and more easily obtained locally than ¼in. and ⁵⁄₁₆in. The ⅜in. bearings are Oilite bushes pressed into steel housings but a push-fit in the endplates to which the housings are bolted.

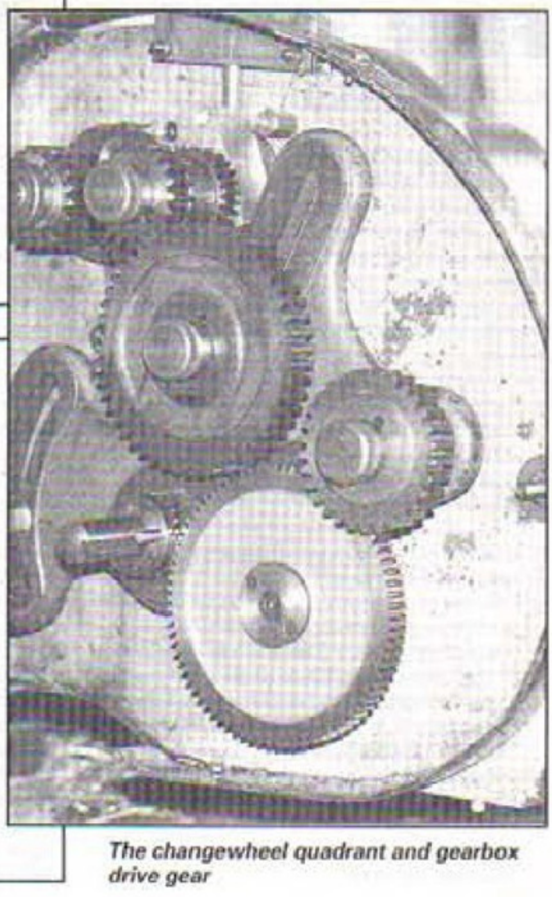




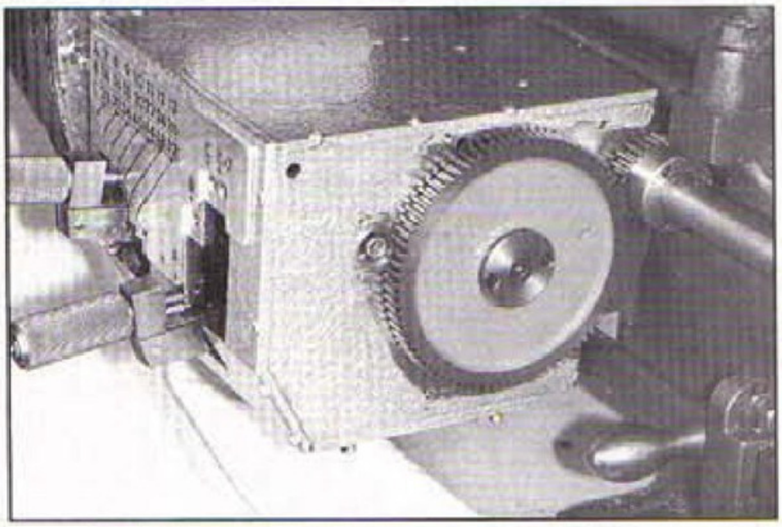


Notes on individual items

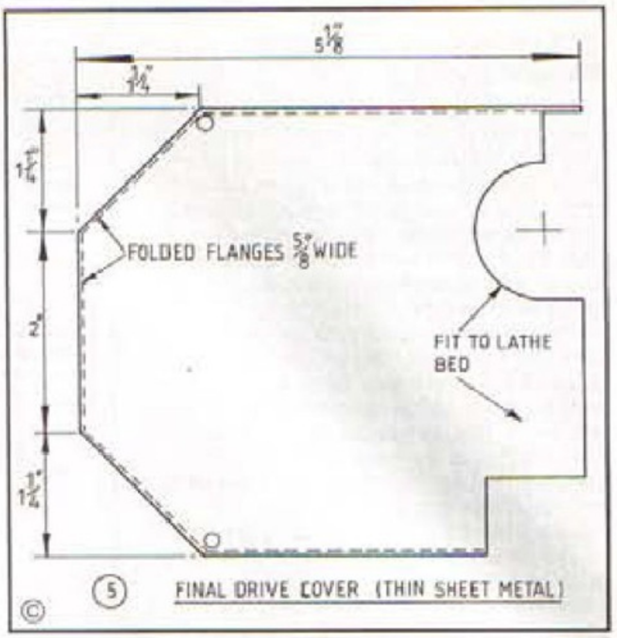
To keep the layout as compact as possible the heavy cast iron lever on the clutch housing was replaced by a ⁵⁄₁₆in. MS lever. For the same reason the gearbox backplate does not extend to the left half of the box.



The changewheel quadrant and gearbox drive gear



The view of the output end of the gearbox with the final drive cover removed.



The first 25T 20 DP Myford gear is not large enough to be drilled for the driving pin of type M changewheels, so has screwed to it a collar ¼in. long with a hole which will take a shortened driving pin and has its own pin diametrically opposite.

Both 80T gears are keyed to their shafts and retained by ⅛in. countersunk screws through washers screwed to the gear boss. Their shafts are retained by collars with 6BA grubscrews between the Oilite bushes. (The original design used a circlip).

Dimensioned sketches are given of the gearbox plates. Mine were cut from 3/16in. MS which unfortunately had been sheared to width slightly undersize and was not particularly flat. Hopefully other constructors may obtain something better.

The gearchange levers are varied in shape and their detents need extra clearance and travel as shown. The detent holes were drilled (at an angle where necessary) by using a drill guide bush screwed in the lever in place of the detent assembly.

The information plate on the front is of aluminium. After shaping it was fixed on the lathe faceplate and the straight lines engraved with a tool held in a machine vice on the vertical slide. The lines were filled with black paint, the surface finished with "wet-or-dry" and the letters and figures added with rub down dry transfers, protected with two spray coats of lacquer.

Conclusion

By the use of 25T-80T driving gears the gearbox runs at less than one third normal speed and so is reasonably quiet even in fine feed mode despite the home cut gears. First use of the gearbox was in making a new cross-slide feed screw with nearly 9in. of ½in. 10 TPI square thread. Both fine feed and screw-cutting went very well and I would commend the design, either in its original form or as modified, to anyone interested.

A DIVIDING HEAD FOR THE PEATOL LATHE

Part 2 Continued from page 52

The operation of the arms is straightforward; they are locked in position so that they uncover one more hole than the number of holes to be moved between each division. Sector arm 1 is rotated clockwise to rest against the plunger, the indexing arm is advanced clockwise until it reaches the other arm, and the plunger dropped into the hole. The kink in sector arm 2 prevents the arms from being opened out to an angle greater than about 240 deg., so when it is necessary to traverse a number of holes that spans a greater angle, there are two possible solutions:

1) Use the outer edges of the arms as the reference points, or:
2) Use the arms in reverse; in other words, set the angle between the arms to uncover one more than the remainder of the holes in the circle and rotate the arms anti-clockwise between divisions. For example, if the movement was to be 15 holes in a 20-hole circle (therefore normally requiring 16 holes to be uncovered, which would be greater than 240 deg.), set the arms to reveal 6 holes and move the arms anti-clockwise between divisions.

Future developments

I mentioned earlier that I am now thinking through the design of a Mark 2 dividing head. I happened to pick up a 1MT live centre at the Midlands exhibition, thinking that I would somehow adapt it for use with the Peatol lathe. It occurred to me that if, instead of modifying the live centre, I was to build a replacement tailstock with a 1MT socket, it would be capable of taking any 1MT tooling I had to hand. It was a short extrapolation from this idea to re-designing the head, with a 1MT socket forming the output shaft in place of the modified drill chuck arbor. The versatility of the head would then be much improved, as any 1MT-based workholding device could be pressed into service. A little thought about easy ways to make an output shaft with an integral 1MT socket resulted in an interesting possible answer; use a (non-hardened) 1MT to 2MT adaptor sleeve as the starting point, and turn down the outer 2MT taper to a ⅝in. dia. parallel shaft. Apart from the obvious advantage of allowing the use of 1MT tooling, the increased output shaft dia. will result in much improved rigidity. Funnily enough, Tracy Tools was able to supply me with just such a sleeve for a modest fee, and my rough work on the design so far seems indicate that it can be suitably machined without disastrously reducing the sidewall thickness (and therefore rigidity). Other likely modifications in Mark 2 will include moving the brake assembly from the front end of the shaft to reduce overhang, and redesigning the main frame on the basis of a sole-plate (exchangeable for different sizes/designs for specific applications) with a solid aluminium block attached, the latter carrying the worm drive, indexing gear and brake assembly in place of the fabricated aluminium angle frame shown in the Mark 1 version. Tricky aspects of this design will include the need to bore out the worm wheel to ⅝in. dia. to take a much more substantial shaft, but for the faint hearted, HPC Gears can supply such as specials for an additional fee.

A simplification of this design (no indexing facilities or worm drive, fixed 1MT socket) could form the basis of a useful replacement tailstock, providing a much improved arrangement for sensitive drilling on the Peatol lathe. A deluxe (if expensive) tailstock would result from attaching this device to an extra saddle and cross-slide.

I will submit a follow-on article to the editor if any of these embryonic ideas lead to fruition!

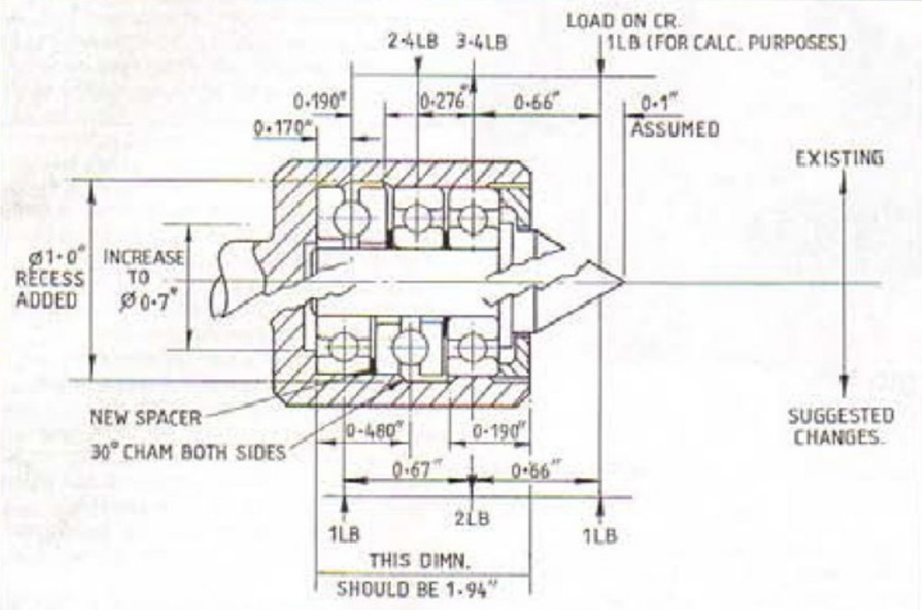
Supplier addresses:

HPC Precision Components Ltd, Storforth Lane Trading Estate, Chesterfield S41 0QZ. Tel. 0246-209683

Tracy Tools Ltd, 2 Mayors Avenue, Dartmouth, South Devon, TQ6 9NC. Tel. 0803-833134

SCRIBE A LINE

Your views, your pages! Your opportunity to make your point, ask the question or simply pass on a snippet of interesting advice to others. Your letters for publication in Model Engineers' Workshop are always welcome



SUGGESTED CHANGES TO 'ROTATING CENTRE' DESCRIBED IN NOV/DEC ISSUE OF M.E.W. ©

Improved rotating centre

A D Hickman suggests some changes to the rotating centre published on page 21 of issue 20.

I would like to paint out a possible problem with the thrust race called up. In my SKF catalogue both washers are the same outside diameter and are made to almost identical tolerances as the ballraces used (+0 -13μm for thrust race and +0 -9μm for ballrace).

This is alright for the stationary washer but the rotating one is not going to go round for long.

An easy solution would be to grind the O.D. but a more practical way would be to relieve the bore of the housing locally as shown in the top half of my drawing.

Another less important point is the bore of both washers is 1mm bigger than the shaft.

I would like to suggest a rearrangement of the bearing, as shown in the lower half of my drawing which would give a much better and more stable set up, also considerably reducing the load on the radial bearing.

The load figures given are of course purely for comparative purposes and not intended to represent actual figures.

Emphasis on safety

From T Rose of Ipswich

With reference to the article in issue No.20 by Martin Howell, Building a small compressor, *I feel I must point out, as a refrigeration engineer, that on a point of safety, cutting into a system charged with refrigerant can be dangerous as liquid refrigerant can cause frostbite and is particularly dangerous to eyes.*

The article also states "it is a sensible idea to prevent this (CFC) escaping to the atmosphere". It should really read "it is illegal ..."

Preferred correction fluid

From Brian Smith of Burnis, Tasmania

I beg to differ on the product suggested in Quick-Tip *page 24, issue No.18.*

This correcting fluid is the saviour of the silversmith, keeping the previous joints stable, while soldering further joints. The problem is, the product mentioned in your Quick Tip *must be spirit base, i.e. you have to buy "thinners".*

The product we use is water-based, and is therefore not flammable as yours would be. The clay base gives it good heat protection. Also, due to the danger associated with children "sniffing" the product, only water-based fluid is permitted in most schools down here.

Drummond Lathes and Steam Aviation

Don Lee writes from Huntly, New Zealand

I received my copy (No.20) of Model Engineer's Workshop *to days ago and have noticed your inclusion of my letter regarding older magazines, for which I thank you sincerely.*

However, the reason for this letter is to say that Mr Arthur Whittaker's unnamed lathe, as shown on page 8 of issue number 18 for Aug./Sept., is a Drummond as was suspected, and is also confirmed in the present issue No.20 of M.E.W. *by Mr. D. Dunnico of Manchester.*

Mr Whittaker's lathe has a few slight additions and modifications from the original but it nevertheless is still a very useful machine which will give much pleasure to its user.

It was originally a treadle operated model, as anyone will notice, and the addition of an electric motor is a good improvement. The lever-operated tailstock barrel movement is an addition of which details were often given in Model Engineer *of past volumes. The changewheels all appear to be a complete set of 14 wheels, ranging between 20 and 73 teeth, and 14 DP, including two each of 20 and 30 teeth.*

This particular model was manufactured between the years 1912 to 1921, and succeeded an earlier type which had a leadscrew centrally situated inside the bed casting. In turn, it was replaced by a later model without the cast "overarm" included upon the headstock.

The overarm type was known as the "B" type machine, and its successor was the "M" type lathe which was produced by Drummond Bros. until its manufacture was taken over by Myfords in 1943 due to priority with other machines owing to the 2nd world war effort.

One final point, on a different subject altogether is that you have stated that you would like to see a copy of a certain advertisement in Model Engineer, *dated 23 Nov. 1939, regarding a book or magazine concerned with Steam Car Development and Steam Aviation.*

Thank you for an interesting and useful magazine.

(The British Library have copies of Steam Car Developments and Steam Aviation *for the period 1934-1945. Magazines prior to 1984 take two hours to be made available as they are not held on site. It is possible to telephone to request magazines to be ready on arrival. Telephone No. 071-636 1544. - Ed.)*

No expense spared

Jonas Beausang of Rottneros, Sweden has a very expensive 3 jaw chuck. Can anyone explain its purpose?

First, I would like to contribute to the scrap box with a tip: Buy some old lorry pistons from a car breaker and cut them off. I bought six for less than £2. Each gave me a round slice of aluminium 5 x ¾in. Besides they can be made into very good ashtrays.

Then I would like to ask the Editor why three jaw chucks with soft jaws have not been mentioned in M.E.W.?

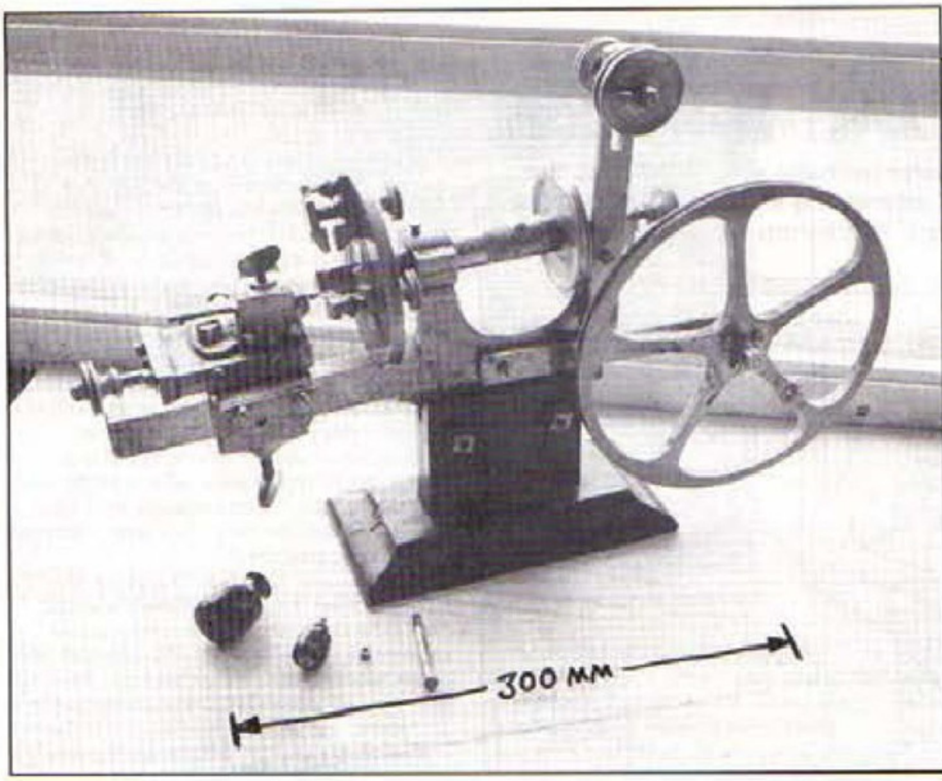
One often reads that the three jaw chuck is not accurate, and you should put the work in a four jaw chuck and centre the work.

Is it the case that chucks with soft jaws are unusual in England? Or do you not agree when I say that a three jaw chuck with soft jaws runs true after you have turned off a bit to suit the workpiece in question?

The drawback is of course the you have to replace the jaws when you have turned off too much, but only the upper part of the jaw which is soft; the bottom part of the jaw is hardened.

Even if you think it doesn't run 100% true (which chuck does?) I can assure you that it runs much more truly than an ordinary three jaw chuck.

These chucks are sold in Sweden with three sets of jaws (inside, outside and soft).



Collector's item?

From Gerhard Gunnarsson of Karlstad, Sweden

I have an old lathe which I purchased by mistake. The purchase was made over the phone from a person who did not know anything about machines. I thought I was purchasing an old Unimat SL; instead, that seen in the photograph arrived. Is it a watchmaker's lathe? Can any reader tell me more about it? If there is a collector of such items interested in the lathe, I would be willing to part with it for a suitable sum.

And they are no more expensive than ordinary three jaw chucks.

I recently bought a secondhand combination three jaw chuck. It is independent and self centring. To call it self centring is perhaps not correct but the jaws can either be moved all at the same time or one jaw at the time depending on where I put the chuck key.

I think it is easier to centre a workpiece in this chuck than in an independent 4 jaw chuck. I was told it was very expensive when new (£700) but I paid far from that.

I wonder what is the purpose for such a chuck, or who uses it? I think it has been used on a grinding machine.

No need for errors

From J. P. Shenton of Hindhead.

The cutting of metric threads in a lathe with an Imperial leadscrew has featured recently in your journal and elsewhere. Always the emphasis seems to be on reducing error down to an acceptable degree. Why have any error? Why not fit a train of changewheels which will provide a true metric thread?

With the ratio 25.4 linking millimetre to inches it is essential to introduce this figure (or a multiple thereof) into the gearing. The smallest gear having this requirement has 127 teeth. Taking the Myford Super Seven with gearbox as an example the table shows the arrangement required for a wide range of threads.

Production of a 127-tooth gear is an interesting but straightforward task despite the fact that an indexing plate with 127 holes is not a standard feature and will require to be made. Marking-out 127 divisions can best be done by turning-down a disc of wood so that the circumference, as measured by a taut fabric tape measure, is some convenient multiple of 25.4 measured in either millimetres or in inches. 508 millimetres will be found a convenient figure. The edge of the disc is then marked-off every 4mm and radii drawn towards the centre and from this the indexing plate may be marked-off and drilled. A No.52 drill working on a P.C.D. of 4½in. will avoid any risk of the holes overlapping. The new indexing plate can then be used direct or through the medium of a dividing head. Use of a dividing head carries the advantage that any small errors in hole-drilling will be diminished by a factor of 60, thereby making the end-product that much better than the tool which created it.

The 127 tooth gear will have a diameter just under 6½ inches. It turns out well if made in fabric-reinforced Tufnol.

METRIC THREADS
Gear trains for Myford Super Seven with gearbox

Driver	Intermediate Stud	Gearbox	Selector	Pitch mm
60	30 60	127	48	0.5
60	30 60	127	32	0.75
60	30 40	127	16	1.0
60	30 50	127	16	1.25
60	30 60	127	16	1.5
60	30 70	127	16	1.75
60	30 40	127	8	2.0
60	30 50	127	8	2.5
60	30 60	127	8	3.0
60	30 70	127	8	3.5

A note of appreciation

From A.J. Reynolds this letter of appreciation for the assistance given as a result of his request for information on South Bend lathes. *S.A.L.* issue 19. There have been even more replies since Mr Reynold penned this letter.

I would like to submit this letter of thanks by way of your S.A.L. *column, to all the very kind readers of* M.E.W. *and* M.E. *I have been given more information than I could ever hope to use. I have obtained a user manual and various bits I required with a promise of further spares if I needed them; when my finances allow. I have come to realise that the model and mechanical engineers both professional and amateur are the most helpful group I have ever encountered, the camaraderie is tremendous. So many thanks to Taff, Peter Ellis, Harry Reay in Houston, Texas, the gentleman in Cape Town, S.A., and all the kind folk who took the trouble to give me information over the phone but never left a name. All the letters I received from* M.E.W. *I will attempt to reply to, especially the gentleman from whom I purchased the spares for getting off the ground, a special thanks.*

Another South Bend look-alike

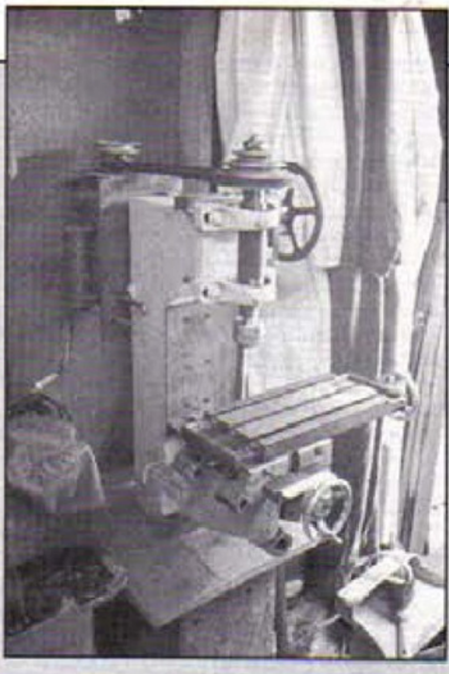
Michael Ruska of Carina, Australia, provides some details regarding another maker of South Bend lathes.

I enclose a copy of the manufacturer's parts list for a Hercus lathe, this is almost identical to a South Bend. F.W. Hercus Pty. Ltd., are at Thebarton, South Australia. Also A & R Transmissions of 1 View Street, North Coburg, 3058, Australia (03 350 1638) provide spare parts and accessories for South Bend and Hercus lathes. Their list also mentions Sheraton lathes as being similar to South Bend. I do hope this information will be of help to readers of M.E.W.

A surface grinder, maybe?

R.P. Neave of Manningtree has an old, and very much modified, machine tool. Can any reader provide answers to any of the questions he poses?

I enclose some photos of my ancient milling machine in the hope that another reader may be able to identify the machine. The column is cast into the baseplate and a lot of extraneous modifications seem to have been carried out on the machine. I fitted the bevel geared mod. to the vertical screw, which originally had a plain crank handle horizontally on the top of the screw. I think that this arrangement was itself not original either. The pillow block bearings which support the vertical spindle are patently NOT original, but "do the job" after a fashion! You will see that I have fitted a 'H.H.' design milling chuck (issue 5) to the spindle in place of a 'sort of' tapered collet which was hopeless at holding cutters in position. The milling table also appears to be partly fabricated in that the slots are formed by steel strips machine screwed to the cast ridges in the table top and then either surface ground or "endmilled all over". The longitudinal table screw was 'UGH', originally external along the front of the machine with a 'V' threaded screw of 10 TPI but I have replaced this with a square threaded screw of similar TPI taken from a



vehicle 'scissor' type jack found at a car boot sale. I am still trying to find a slightly thicker screw for the cross feed which at present has a 6 TPI screw and which I think is original fitment. The spindle drive arrangement and the motor mounting are rather crude and obviously not original. When I have finalised the machine to my satisfaction I will fit a suitable belt guard. I should add that all the handwheels in the photos were fitted by me, those on the machine when I acquired it were rather clumsily made cranks, one was even a car window winder handle. When I first got it the 'flat' face on which are mounted the pillow block bearings, was not vertical or square to the table and the set up I employed to try and achieve this would take another half hour to describe, but it does seem to have worked. I am intrigued by the hollow boss beneath the knee of the machine and also the two lugs on the left side of the knee, a steel spindle or pivot pin was in these but for what purpose I would like to know. My final comment on the machine is that it is too fast for he majority of milling operations and I am contemplating using an old motorcycle type gear box as a variable speed drive and complete with clutch. I also wonder if it is possible to adapt the machine also to operate as a horizontal miller on occasion.

I have just made your design of tool height setting gauge (issue 5) and am very pleased with it.

Tri-leva attachment

S.C. Robinson of Newtownabbey would like to make his own version of the Tri-leva speed setting attachment.

I understand that the Tri-leva attachment for Myford lathes is no longer available.

I would like to make and fit a version of this to my ML7. Could some of your readers who have the Tri-leva please send photographs, drawings or even sketches of same, so that I could make this fitment. I am a pensioner and spend a lot of time in my workshop.

Maybe one of your readers would like to get in touch with me through M.E.W. or if someone who has a Tri-leva and lives in N. Ireland would permit me to visit them to take sketches.

Left hand drills and broken screws

From G.N. Hemmings of Birkenhead

Reading Trade Counter *and* Scribe a Line *in the Nov./Dec. issue prompts me to make the following comments.*

The Black & Decker Minicraft Drills are the ideal tools for removing very small screws, as their high speed and very comfortable "sit" in the hand makes the use of small drills quite straightforward. I regularly use down to 0.7mm in one. Some models of Minicraft use a connector where the polarity can be reversed, and I keep a few flat drills sharpened to cut left-handed. Drilling a broken screw with a L.H. drill will often bring it out without bother.

With this, and with all my power tools I use a foot switch, but contrary to Herr Dussel's way I find that after driving cars all my adult life it is instinctive to lift the foot (and switch off) at the slightest sign of trouble. I make footswitches by buying a 10amp microswitch and building this into a shallow wooden box. I feel much safer with my foot controlling the power.

Tools at the ready

From Harold Lewis of Hilo, Hawaii

There is a better way for Mr. Joe Ginn (M.E.W. No.19, p.8) to keep parts and tools at hand and restore the indulgent Mrs. Ginn's baking pan to the kitchen: a magnetic bar attached to the lathe or milling machine bench.

Heavy tools, like milling vise handles and large wrenches and heavy parts are firmly held by the bar – and can be placed on it with hardly a glance. And Mr. Ginn's well developed sense of discipline need not atrophy. After all, he must remember to put the tool on the bar.

(In the U.S. magnetic bars are available from Garrett Wade and Co. Inc., 161 Avenue of the Americas, New York, NY 10013, and from the Reid Tool Supply Co., 2265 Black Creek Road, Muskegon, MI 49444-2684.)

A professional C.A.D. user

John Colley writes regarding the "C.A.D. basics" article

As an avid reader of your excellent magazine since its first issue, I feel the need to take the trouble to sit down and write these few lines. First, to congratulate you on your very concise and informative article on the above subject. As a newcomer to C.A.D. in the Architectural field, (486/50 with AutoCAD R12 with AEC ext'n) and self employed, it is the first occasion that I have seen in print such a simple explanation of the capabilities and functions of CAD.

Despite having read the instruction manuals many times, I have learned a great deal from your article and have now enlarged your Autodesk – Sketch 1 table and will use this as a quick reference for function commands, thus saving me time in my current learning curve.

I am the first to appreciate that these articles will have a limited appeal to the total readership, but will certainly be a boon to those amongst us who wish to employ this medium to our hobbies. I am fortunate enough to have extensive workshop facilities that cover both metal and woodturning activities. You have now encouraged me to do the obvious and use my CAD to thoroughly detail and think through future projects.

My second point is just to say a simple 'thank you'. Your task of continually finding material to fill each issue cannot be easy, but must say your choice of subjects and projects are most interesting.

A timber frame, vertical power hacksaw

Mike Haine of Leamington Spa describes his novel approach to building a power hacksaw.

I must confess to not being too interesting in making models of steam engines and the like. I get more kick out of devising, designing and making tools to use in the workshop. At one stage I realised that a lot of boring time was wasted in hacksawing stock and decided I must build a power hacksaw. Thinking about it I realised that most of it could be made from wood. I then acquired a useful little worm gear box from a derelict agricultural machine in a local farmyard. From several lengths of 1in. tube and pieces of 1x1in. light alloy (local scrap yard), a washing machine motor and 4 V pulleys and belts from same I designed and built my saw. It was mounted on a stiff little custom designed and built bench, about 2x1x1ft high. The use of wood (all from various scrap sources) reduced the manufacturing time from weeks to days. The result worked fine BUT I kept falling over the darned thing in the rather restricted space in my shop.

One day, with a bruised shin, I thought what a crazy idea it was to make such things horizontal; when there was much more vertical space available.

Back to the drawing board. The mechanism was OK but now mounted to saw in the vertical direction. Will now fit on the back of the bench. The design comprises the saw, the motor, drive belts, gear box and slides and saw on a ⅝in. baseboard (block board). There is a table hinged on a shaft (½in. tube) at the base level. The stock vice (homemade on the lathe using the 4 jaw mainly), clamps on the upper surface and is easily adjustable in position and angle. The table is spring loaded against the blade (standard hacksaw blades). The pressure is adjustable by hooking the end of the tension spring on a series of 1in. nails. The blade slopes slightly so that the table moves during the cutting stroke. At the end of the stroke the table is held in position by a very simple clamping device which releases at the end of the backstroke. Thus the blade is clear of the stock except when cutting.

Lubricant is pumped up to the blade by a little pump such as used for pumping blood. A length of rubber tube is squeezed by an eccentric on one of the drive shafts. (Works like a charm!)

It has a little homemade box of electronics which monitors the motor current, neglecting the starting peak but tripping if the current subsequently rises above a preset value. There is also a stop which trips the power on completion of a cut. (So I set it up and get on with the gardening.)

It would no doubt be regarded as a very rough bit of work if shown at an M.E. exhibition. But, by golly, it works and has been for quite a few years!

It is one example of what can be achieved without a lot of effort and little cost. It was all from scrap bits and pieces, though I did have to purchase the blades. (Amazing how long they last when protected from the heavy hand of man!) I know it is usual to judge by standards of fit and finish, not to mention spit and polish. However, in my book the things I look for are ingenuity in design materials, acquisition and manufacture (though accuracy and finish where it matters of course!).

A satisfied CAD user

Lew Parry of Hull writes regarding his experiences in setting up and using a CAD system

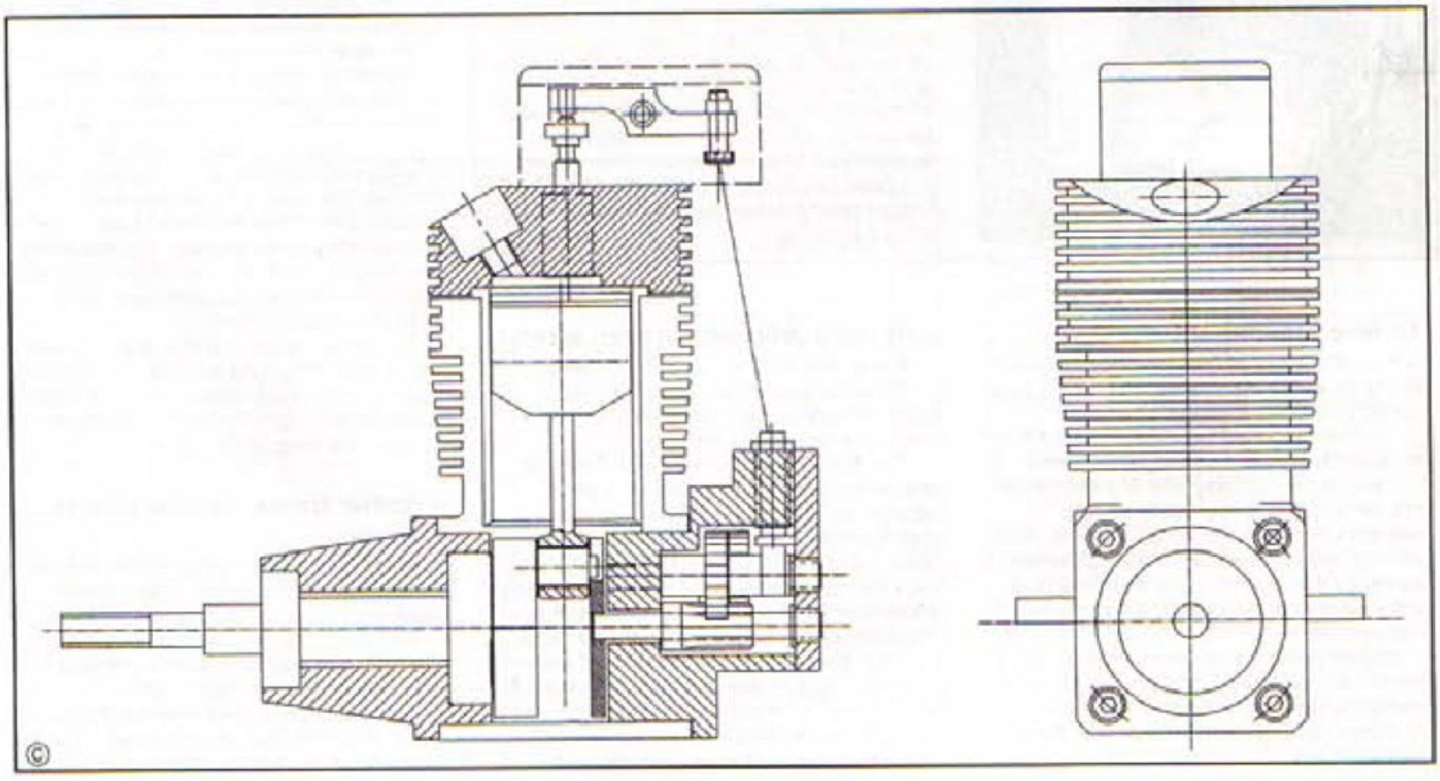
Having just read the CAD basics article in the Nov./Dec. issue with great interest, I thought I would drop you a line outlining my experiences as it may be of interest to readers looking for a cheap but very effective package.

I had decided that I needed a computer for word processing, spreadsheet and hopefully CAD work to help with earning a living as a freelance design engineer. In addition, as a life long aeromodeller and recently model engineer with an interest in I.C. engine design, I felt it would be an interesting addition to the hobby.

Having purchased the computer (a Packard Bell 386) I bought a couple of PC magazines to look at the available software. On the front of one of the mags was a free disc on which was a CAD program. I put this in a drawer not believing that it would be of any use and wrote off for information on various packages. In the meantime I started to learn the basics of handling machine. In one of these sessions my son suggested trying the free disc, what a surprise it turned out to be.

The program is Tommysoft CAD/Draw which is German in origin and can be obtained as a shareware disc from Omicron Systems (0702 710391) for just £5. This allows you to try the system in its entirety and print out your drawings. I used it for two months before sending £48+VAT for the registered version which came with an instruction book and additional data discs. This way you avoid paying out for a package you may not like. I have to say that the instruction book, like so many computer instruction books, is not as crystal clear as perhaps it could be but all the information is there and with a little study and common sense you soon start finding your way around. The more I've used the package the more I've discovered and am amazed by its versatility, it is a very powerful system. I'm enclosing a print of a 15cc fourstroke aeroengine design I'm working on to give you some idea of what it can do, the drawings were produced on a basic 9 pin printer and, I think you will agree, are more than adequate.

My only previous experience of CAD was 5 years ago when we were trying to introduce it into the design office at the company I worked for. We evaluated packages over a year of trials, many of them on 286 and 386 machines and few of them were better than this free sample and all of them were very expensive, way beyond the reach of private individuals. Shortly after installing a system, and before we had a chance to really use it, the company relocated operations abroad and the design office was made redundant to a man. At 59 years of age I thought I would never again have access to such technology and resigned myself to the drawing board. That, I'm pleased to say, has all changed and I'm now enjoying designing models in comfortable surroundings with my wife's company and



numerous cups of tea.

I'm sure that a lot of model engineers would not be interested in spending around £500/£1000 to just design models, and if they could justify the outlay may think that the technology is beyond them. Well think again, my friend Derek Brooks (of cutter grinder fame. Ed.) had acquired an old 286 machine using it as a word processor. I gave him the free disc to try and he became interested. A week later he was producing drawings and he had never seen a CAD system before.

This equipment adds a new dimension to the hobby and allows some of our more fanciful ideas to take shape. The speed with which it is possible to manipulate the images encourages you to try all manner of variations in your design which would be tedious on a drawing board. Having used drawing boards for the last 35 years, and can still churn out drawings if necessary, I doubt if I will use one again. My board in the workshop is already gathering dust.

In conclusion I would ask if a regular (every two copies?) CAD forum would be a possibility in the future. There must be young model engineers out there who have grown up with computer and would take to CAD with relish and it would possibly spark off interest among the older readers. Derek and I are both 62 years old and we wouldn't be without it.

(Tommysoft is a Windows-based system and requires a hard disk with at least 3MB free after installing Windows. Ed.)

The ideal *M.E.W.* index

C.A. Bevan of Victoria, Australia, describes his ideal index for *M.E.W.* and illustrates it precisely with an example from a recent issue.

In the latest issue (No.20) you call for comments re the method of indexing M.E.W.

I would favour the method that gives the most detailed information and consider that a mere accumulated list of article titles would not fulfil that requirement.

My ideal system would index items within an article and can be illustrated in the latest M.E.W. *issue. On page 40 an article starts that would probably be indexed "A Differential Screw Micrometer Head". Fair enough if that was all you wanted, but what about the gem on page 44 about "Spot Grinding"? Would that be indexed anywhere?*

It is that information I want and it is such a system that I use myself on file cards. It meets my requirements well; but then, it would, wouldn't it? I realise, however, that such a system would probably need much work but I do think that aiming in that direction is worthwhile.

Hand cleansers

John Cartright of Newman, Australia, writes on the subject of makeshift hand cleansers.

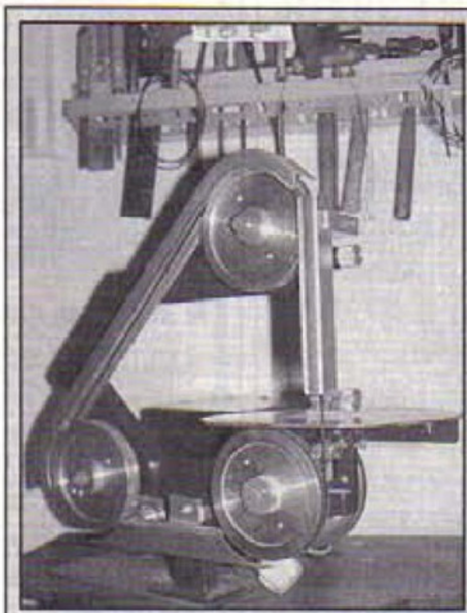
In a recent issue of M.E.W. *No.20 page 23, Quick Tip by M.R. Dickerson suggested using paraffin and washing up liquid as a hand cleaner.*

I would like to point out that paraffin (kerosene in Australia) is a very commonly misused skin cleaning agent.

Paraffin is a petroleum product used for degreasing. The defatting agent which removes grease and oil from the skin causes other side effects including increased susceptibility to dermatitis, characterised by redness and dryness of skin and secondary skin infections.

Similarly, detergents have properties which allow them to dissolve and remove oil and grease which make detergents effective at removing the important natural oils and fats of the skin upon contact. Washing up detergents are skin irritants and can cause allergic dermatitis producing redness, scaling, cracking, itching, dryness and pain even when used regularly at low concentrations.

To be on the safe side avoid using petroleum based products and concentrated amounts of detergents for hand cleaning. There are several hand cleaner products on the market now which avoid using petroleum products and are non-toxic.



A bandsaw problem

Terry Gould of Shrewsbury has made the three wheel bandsaw from issue 2, and poses a question. Can any reader offer an explanation?

I thought you might like to see this 3 wheel bandsaw, as this was built from M.E.W. *plans. Some minor changes were made; e.g. a better guard over the wheels. I would have liked to have had some indication of how much crowning to put on the wheels. As first made, the blade refused to stay up there, as I had too much of a crown, too little and it wanders off. How does a blade or flat belt stay on a curved wheel/roller when reason says it should slide off? An excellent tool.*

L.I. Hansford of Maidenhead also writes on the subject of hand cleansers.

Recently there have been a number of references to using old sump oil for things like hardening tools.

Can I suggest that when you change your oil you refill the container with the horrible gunge (yes, all of it) and take it down to your local tip for safe disposal. The point is that it really is unfriendly stuff and is best avoided if the opportunity is there. That black colour and acrid smell come from a whole range of different chemicals resulting from the partial combustion of hydrocarbons. I am given to understand that if you were to look up the properties of some of these you would probably swear never to go near the engine again. Clearly one has to keep a sense of proportion about this sort of thing but all the same getting it on the skin any more than necessary is definitely not recommended as it can sink in and be absorbed. New oil is a very different kettle of fish but these days so many additives are put in that I don't think one can take it for granted that it is 100% safe to smother oneself in it. Perhaps one of the oil companies would care to comment.

Along similar lines, a Quick Tip *from Mr. Dickerson suggested using a mixture of paraffin and washing up liquid as a hand cleaner. I agree that it is an excellent degreasing agent (I reckon as good as some commercial ones) but it does have the nasty habit of doing the same thing to the skin. Also paraffin is not terribly friendly either and will soak in.*

Fortunately, there is a much safer alternative lurking under the wife's control in the kitchen. In recent years cooking oils have come down in price to the point that they are cheaper than all but the most dubious lubricating oils. Obviously they are just as effective for hardening purposes, but here is the interesting bit. Next time you are working on the car and get black grimy hands ask the missus to pour a bit of her oil into the palm of your hand and use that instead. If you work it well in you will find that it will shift all that obstinate muck. All you need do then is wash your hands with ordinary soap and water a couple of times and you will have amazingly clean and smooth hands. Unlike paraffin, cooking oil is not really a solvent. It simply mixes with other grease and oil and since it is easily emulsified by ordinary soap takes the dirt with it. And common sense says that using something that you normally eat has to be safer.

Barrier Creams are also widely known about but are, I suspect, little used in the amateur field. These are usually based upon lanolin (which is sheep's wool fat) in an emulsified state. The idea is to top up the skin's natural grease and fill up all its pores with something friendly before they get filled with something nasty. In reality you don't have to use lanolin as any meat fat is pretty good. The snag is that unless highly refined they all tend to go rancid quickly and can harbour all sorts of bugs. So back to the cooking oil. Why not rub some into your hands before you do that dirty job? After all, it can't do you any harm, is barely noticeable, must lessen the amount of sump oil, or whatever, that does find its way into the skin and I think makes the job of washing easier still.

One way only

Can any one help Mr R.J. Jones of Wolverhampton achieve reverse traverse?

I have a Myford model M lathe dating from 1947. It is in excellent condition with all the accessories. However, the only thing missing is the reverse traverse quadrant casting and the two associate gears so I cannot traverse back or screw cut left hand. Has anyone got such an item or knows of a supplier, or have another suggestion for overcoming this problem.